Volume 8
Number 1
1998

NOVON

Obtegomeria (Lamiaceae), a New Genus from South America

Philip D. Cantino
Department of Environmental and Plant Biology, Ohio University,
Athens, Ohio 45701-2979, U.S.A.

Anton Doroszenko
CAB International, Wallingford, OX10 8DE, U.K.

ABSTRACT. *Obtegomeria* Doroszenko & P. D. Cantino, a new genus based on *Satureja* sect. *Obtectae* Epling & Játiva, is distinguished from the rest of the *Satureja* complex by the combination of stiffly ascending, replicate leaves, lower lip of the corolla nearly to fully as long as the tube, and reticulate pollen. *Obtegomeria* is monotypic and endemic to Colombia. The new combination *Obtegomeria caerulescens* (Bentham) Doroszenko & P. D. Cantino is provided.

The *Satureja* complex (*Satureja* L. s.l.) occurs in both the Old and New Worlds and has been variably treated as a single genus (Briquet, 1895–1897; Epling & Játiva, 1964, 1966) or as many as 17 (Doroszenko, 1985). The authors of this paper have differing views on the classification of *Satureja* s.l. Using a phenetic approach, one of us recognizes seven genera in the New World (Doroszenko, 1985), while the other has made a phylogenetic argument for recognizing only three (Cantino & Wagstaff, 1998). However, we agree that *Obtegomeria* warrants segregation. It is separated from the rest of the complex by a substantial phenetic gap and has four probable synapomorphies. There is no evidence that its segregation would render any other genus paraphyletic. *Obtegomeria* is monotypic and endemic to the Sierra Nevada de Santa Marta in northeastern Colombia.

A numerical cluster analysis (Doroszenko, 1985) found *Obtegomeria caerulescens* to be among the most phenetically distinct species in the complex. It pairs most closely with *Piloblephis* Rafinesque, a monotypic North American genus that has been excluded from *Satureja* (Cantino & Wagstaff, 1998) based on a chloroplast DNA restriction site analysis (Wagstaff et al., 1995) that did not include *Obtegomeria*. The similarity between *Obtegomeria* and *Piloblephis* is limited to vegetative features (both are ericoid shrubs with tightly revolute leaves); they differ greatly in inflorescence and floral morphology.

Obtegomeria may be distinguished from all other members of the *Satureja* complex by the combination of stiffly ascending, consistently replicate leaves (i.e., so strongly revolute that the lower surface is completely hidden) and a corolla limb that is nearly to fully as long as (i.e., 0.8–1.0×) the tube. These three characteristics are individually rare in the *Satureja* complex and probably apomorphic; their combination is unique to *Obtegomeria*. Many members of the Old World genus *Micromeria* Bentham (part of the *Satureja* complex) have revolute leaves, and the lower surface is sometimes hidden when the leaves are narrow, but this is rarely a consistent feature as in *Obtegomeria*. In the New World members of the *Satureja* complex, replicate leaves occur only in *Obtegomeria* and *Satureja fasciculata* (Bentham) Briquet (better treated as a species of *Clinopodium* (Cantino & Wagstaff, 1998), but the new combination has not been made). *Satureja fasciculata* lacks the other distinguishing features of *Obtegomeria* and differs so greatly in calyx and inflorescence morphology that

a close relationship seems very unlikely. Similarly, floral and inflorescence morphology and geography argue against a close relationship between *Obtegomeria* and the replicate-leaved species of *Micromeria*. Thus we hypothesize that replicate leaves evolved independently in these taxa.

Another probable apomorphy of *Obtegomeria* is its reticulate pollen (Wagstaff, 1992). Reticulate pollen (as opposed to microreticulate, suprareticulate, or both; terminology follows Vezey et al., 1992) is rare in the Labiatae (Pozhidaev, 1989; Trudel & Morton, 1992; Wagstaff, 1992; Abu-Asab & Cantino, 1994), but a much larger sample of *Satureja* s.l. will be needed before one can be confident that this feature is diagnostic of *Obtegomeria*.

Cantino and Wagstaff (1998) opposed recognition of many of the segregate genera of *Satureja* s.l. because doing so would render other genera paraphyletic. There is no evidence that this is the case for *Obtegomeria*. We are unaware of any species within another genus that one could argue might be its sister group. Indeed, it is so distinctive that we cannot suggest what its closest relative might be. From both phenetic and phylogenetic perspectives, it merits recognition at the genus level.

Obtegomeria Doroszenko & P. D. Cantino, gen. nov. Based on *Satureja* sect. *Obtectae* Epling & Játiva, Brittonia 16: 407. 1964. TYPE: *Satureja caerulescens* (Bentham) Epling.

Frutices ericoides; folia subsessilia, rigide ascendentia, replicata, pagina infera obtecta; calyx valde zygomorphus, tubo 11–13 nervi; corolla bilabiata, labio infero tubum fere vel perfecte aequantem; pollinis grana 6-colpata, reticulata, non suprareticulata.

Low ericoid shrubs; leaves subsessile, stiffly ascending, linear-oblong, replicate, lower surface completely hidden; flowers axillary, solitary, with 2 lanceolate bracteoles near base of pedicel; calyx strongly zygomorphic, tube 11–13-nerved, densely villous in throat, upper three lobes deltoid-cuspidate, fused to form a lip, lower two lobes lance-subulate, free above tube; corolla bilabiate, tube funnelform, upper lip flat, deeply bifid, lower lip 0.8–1.0× the tube, 3-lobed, median lobe largest, notched; stamens four, didynamous (anterior pair longer), included, thecae divaricate, not confluent; pollen 6-colpate, reticulate, not suprareticulate; style unequally 2-lobed; nutlets ellipsoid, glabrous.

Etymology. From Latin obtegens (covering over) and Greek meris (a part), referring to the hidden lower surface of the leaf.

Obtegomeria caerulescens (Bentham) Doroszenko & P. D. Cantino, comb. nov. Basionym: *Hedeoma? caerulescens* Bentham, in A. DC., Prodr. 12: 245. 1848. *Calamintha caerulescens* (Bentham) Weddell, Chlor. Andina 2: 149, t. 63. 1860. *Clinopodium caerulescens* (Bentham) C. Kuntze, Revis. Gen. Pl. 2: 515. 1891. *Satureja caerulescens* (Bentham) Epling, in Repert. Spec. Nov. Regni Veg. Beih. 85: 156. 1936. TYPE: Colombia. Magdalena: Sierra de Santa Marta, *Purdie s.n.* (holotype, K; isotypes, E, GH).

Satureja lindeniana Briquet, Annuaire Conserv. Jard. Bot. Genève 2: 191. 1898. TYPE: Colombia. Sierra de Santa Marta, *Funck 394, Schlim 821, Linden 1622* (syntypes, G).

Acknowledgments. This research was carried out at the Royal Botanic Garden in Edinburgh (Doroszenko) and the Harvard University Herbaria (Cantino), and we wish to thank the staff of both of these institutions for facilitating our work. Travel support to Harvard was provided by the Arnold Arboretum's Mercer Fund and the Ohio University Research Committee (grant #9957). We are grateful for the opportunity to examine specimens of *Satureja* s.l. from the following herbaria: A, B, BHO, BM, C, E, FM, G, GH, HUJ, K, LD, M, MANCH, MO, NY, P, UC, US, W, WU, and Z.

Literature Cited

Abu-Asab, M. S. & P. D. Cantino. 1994. Systematic implications of pollen morphology in subfamilies Lamioideae and Pogostemonoideae (Labiatae). Ann. Missouri Bot. Gard. 81: 653–686.

Briquet, J. 1895–1897. Labiatae. Pp. 183–375 *in* A. Engler & K. Prantl (editors), Die natürlichen Pflanzenfamilien, Teil 4, Abt. 3a. W. Engelmann, Leipzig.

Cantino, P. D. & S. J. Wagstaff. 1998. A reexamination of North American *Satureja* s. l. (Lamiaceae) in light of molecular evidence. Brittonia 50: 63–70.

Doroszenko, A. 1985. Taxonomic Studies on the *Satureja* Complex (Labiatae). Ph.D. Dissertation, Edinburgh University. [Library copies are available at Edinburgh University, Royal Botanic Gardens (Kew), Missouri Botanical Garden, and Ohio University.]

Epling, C. & C. Játiva. 1964. Revisión del género *Satureja* en America del Sur. Brittonia 16: 393–416.

——— & ———. 1966. A descriptive key to the species of *Satureja* indigenous to North America. Brittonia 18: 244–248.

Pozhidaev, A. E. 1989. Exine structure in pollen grains of the Lamiaceae family. Bot. Zhurn. 74: 1410–1422.

Trudel, M. C. G. & J. K. Morton. 1992. Pollen morphology and taxonomy in North American Labiatae. Canad. J. Bot. 70: 975–995.

Vezey, E. L., V. P. Shah & J. J. Skvarla. 1992. A numerical approach to pollen sculpture terminology. Pl. Syst. Evol. 181: 245–254.

Wagstaff, S. J. 1992. A phylogenetic interpretation of pollen morphology in tribe Mentheae (Labiatae). Pp. 113–124 *in* R. M. Harley & T. Reynolds (editors), Advances in Labiate Science. Royal Botanic Gardens, Kew.

———, R. G. Olmstead & P. D. Cantino. 1995. Parsimony analysis of cpDNA restriction site variation in subfamily Nepetoideae (Labiatae). Amer. J. Bot. 82: 886–892.

A New Species of *Dubautia* (Asteraceae–Madiinae) from Kaua'i, Hawaiian Islands

Gerald D. Carr and David H. Lorence
Department of Botany, University of Hawaii, 3190 Maile Way, Honolulu, Hawai'i 96822 and National Tropical Botanical Garden, P.O. Box 340, Lawai, Hawai'i 96765, U.S.A.

ABSTRACT. *Dubautia syndetica* G. Carr & Lorence from the Hawaiian Island of Kaua'i is described and illustrated. The new species is distinguished from congeners on the basis of its combination of uniseriate, somewhat coalescent receptacular bracts, coarsely glandular peduncles, glandular corolla tubes, and conspicuously strigose achenes. These and other features suggest a possible hybrid origin from *D. laxa* Hooker & Arnott subsp. *hirsuta* (Hillebrand) G. Carr and *D. raillardioides* Hillebrand.

The most recent monograph of the Hawaiian endemic genus *Dubautia* (Carr, 1985) recognized 21 species in three sections: *Dubautia* sect. *Dubautia*, consisting of 10 species of diverse, mostly mesophytic shrubs and small trees with 14 pairs of chromosomes; *D.* sect. *Railliardia* (Gaudichaud) G. Carr, consisting of 10 species of mostly xerophytic shrubs and small trees with 13 pairs of chromosomes; and *D.* sect. *Venoso-reticulata* (A. Gray) G. Carr, comprising a single lianous species with 14 pairs of chromosomes. These species, together with those of the Hawaiian genera *Argyroxiphium* and *Wilkesia*, constitute the Hawaiian Madiinae (Asteraceae), a group of 28 morphologically and ecologically highly diverse, yet closely related species otherwise known as the Hawaiian silversword alliance. This group of plants has been the subject of more than 20 years of intensive experimental studies, including investigations of biosystematics and cytogenetics (Carr et al., 1989; Kyhos et al., 1990; Carr et al., 1996), flavonoid chemistry (Crins & Bohm, 1990), physiological ecology (Robichaux et al., 1990), population genetics (Friar et al., 1996; Witter, 1990; Robichaux et al., 1997), phytogeography (Baldwin & Robichaux, 1995), and molecular systematics and evolution (Baldwin et al., 1991; Baldwin, 1997). As illuminated by the aforementioned experimental studies and the earlier anatomical and morphological observations summarized by Carlquist (1970, 1974), the silversword alliance provides a premier example of the process of adaptive radiation in plants.

While synthesis of information regarding comparatively well-known species of the silversword alliance has been the focus of several workers, leading field botanists in the Hawaiian Islands continue to discover species new to science. A collection in 1985 by Tim Flynn, Curator of the Herbarium at the National Tropical Botanical Garden, first called attention to the species described herein. Flynn's specimen from the Wahiawa Mountains of Kaua'i was thought to represent a single plant growing at a single site in the vicinity of *Dubautia laxa* and *D. raillardioides*. For this reason, and because the material seemed to combine features of these species, it was annotated by one of us (GDC) as a hybrid. A few years later, field botanists began to detect plants with the same unique suite of characters in other areas of the Wahiawa Mountains, and often not closely associated with other species of *Dubautia*. Subsequently, the authors visited the site together and found no evidence that these plants represent primary or recent hybridization. Although we hypothesize a hybrid origin for this taxon, it appears to be as reproductively stable as any normal sexual species, and therefore worthy of formal recognition.

Dubautia syndetica G. Carr & Lorence, sp. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Koloa District, Lihue-Koloa Forest Reserve, Wahiawa Stream and Mts. along main Wahiawa Stream near headwaters, low wet forest, 705–710 m, 13 June 1991, *D. H. Lorence, T. Flynn, K. Wood & S. Perlman 6782* (holotype, BISH; isotypes, F, HAW, MO, NY, PTBG, US). Figure 1.

A speciebus aliis *Dubautiae* sectionis *Dubautiae* bracteis receptaculi uniseriatis nonnihil coalescentibus, pedunculis grosse glandulosis, tubo corollae glanduloso, acheniis insigniter strigosis differt.

Openly branching shrubs 1–2(–3) m tall, vegetative stems glabrous to sparsely hispidulous, mostly pale, gray-brown when dry, the leaf scars mostly glabrous; flowering stems usually hispid. Leaves opposite, commonly 4–16 cm long, 1–3.5 cm broad,

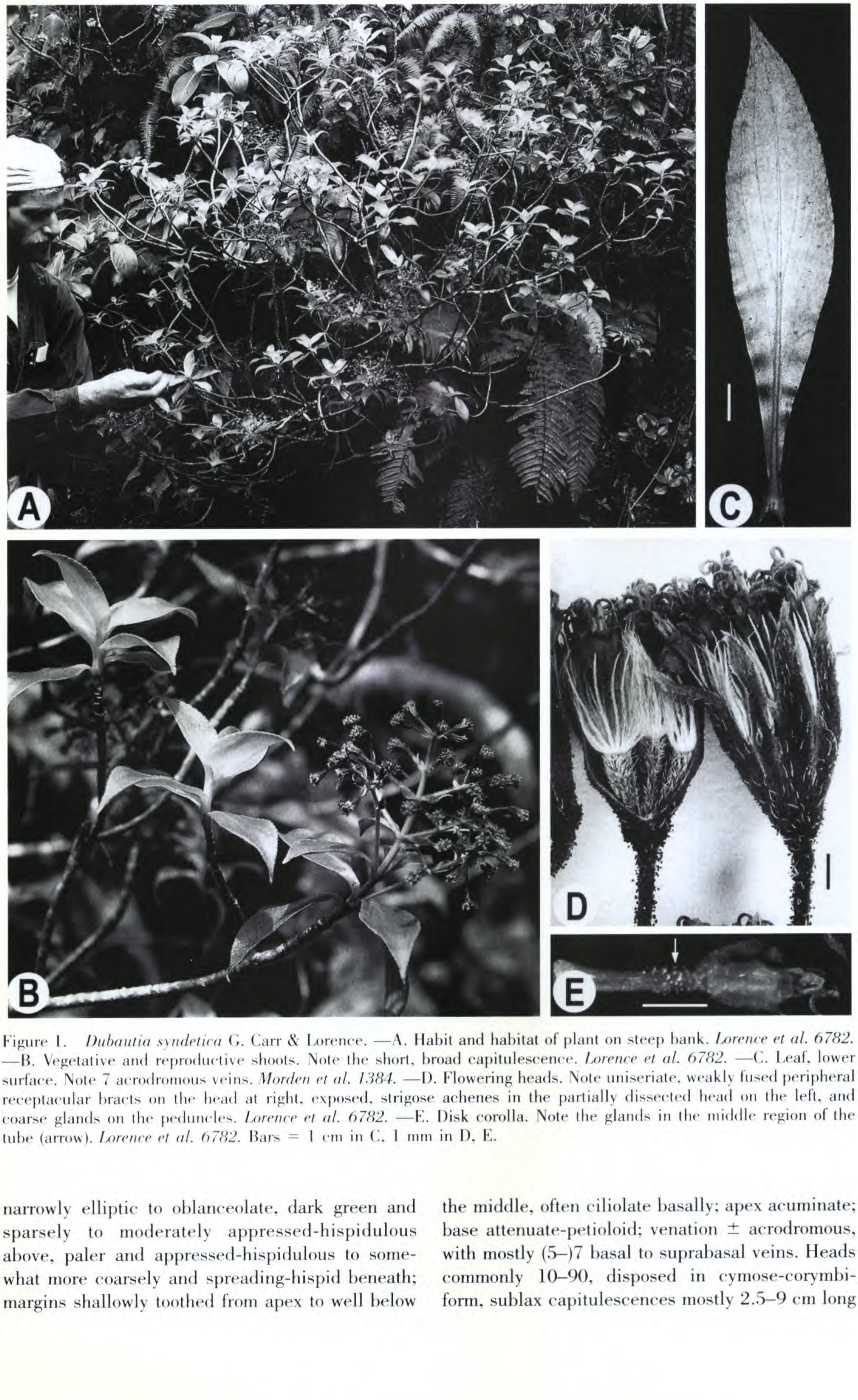


Figure 1. *Dubautia syndetica* G. Carr & Lorence. —A. Habit and habitat of plant on steep bank. *Lorence et al. 6782.* —B. Vegetative and reproductive shoots. Note the short, broad capitulescence. *Lorence et al. 6782.* —C. Leaf, lower surface. Note 7 acrodromous veins. *Morden et al. 1384.* —D. Flowering heads. Note uniseriate, weakly fused peripheral receptacular bracts on the head at right, exposed, strigose achenes in the partially dissected head on the left, and coarse glands on the peduncles. *Lorence et al. 6782.* —E. Disk corolla. Note the glands in the middle region of the tube (arrow). *Lorence et al. 6782.* Bars = 1 cm in C, 1 mm in D, E.

narrowly elliptic to oblanceolate, dark green and sparsely to moderately appressed-hispidulous above, paler and appressed-hispidulous to somewhat more coarsely and spreading-hispid beneath; margins shallowly toothed from apex to well below the middle, often ciliolate basally; apex acuminate; base attenuate-petioloid; venation ± acrodromous, with mostly (5–)7 basal to suprabasal veins. Heads commonly 10–90, disposed in cymose-corymbiform, sublax capitulescences mostly 2.5–9 cm long

and 3–15 cm broad, the lower peduncles puberulous to hispid and sparsely glandular, becoming more glandular above, the upper and ultimate peduncles often obscured by purplish, sessile to short-stalked glands, the ultimate peduncles mostly 2–15 mm long; receptacular bracts 6–13, linear to linear-elliptic, linear-lanceolate or rarely linear-oblanceolate, peripheral, uniseriate, weakly and irregularly coalescent (usually partially or wholly separating on drying), 4.5–7 mm long, usually reddish purple, often sparsely hispid and glandular, especially toward the base; florets usually 8–17, the corolla pale greenish yellow, becoming purple in age, 2.2–3.8 mm long, about equaling the pappus, sparsely to moderately glandular on the tubular portion, rather abruptly dilated distally, apex with 5 triangular lobes, each ca. 0.5 mm long; pappus stramineous to pale tan or reddish purple, comprising 16–26 unequal, very narrowly linear-lanceolate, shortly fimbriate aristae 2.2–3.8 mm long; achenes black, straight or only slightly curved, ca. 2–3 mm long, strigose.

Distribution. This taxon is known only from the region of the headwaters of the Wahiawa Stream, primarily on adjacent slopes of the Wahiawa Mountains draining into the northern end of the Kanaele Swamp basin. The known range is roughly a triangular area approximately defined by Hulua in the southwest, Kapalaoa in the north, and Kahili in the southeast. Populations occur at elevations of ca. 680 to 950 m. Based on rather limited phenological data, flowering appears to occur primarily from March to June.

Habitat. *Dubautia syndetica* occurs as scattered to locally abundant individuals along the banks of the upper reaches of the Wahiawa Stream and its tributaries, and adjacent windward slopes leading to the summit of Kapalaoa. The vegetation is a low stature, diverse lowland wet forest dominated by *Metrosideros polymorpha* Gaudichaud, *M. waialealae* (Rock) Rock, *Antidesma platyphyllum* H. Mann var. *hillebrandii* Pax & K. Hoffmann, *Syzygium sandwicensis* (A. Gray) Niedenzu, *Ilex anomala* Hooker & Arnott, *Perrottettia sandwicensis* A. Gray, *Tetraplasandra* spp., *Cheirodendron* spp., and *Psychotria* spp. with numerous pteridophytes including *Dicranopteris linearis* (N. L. Burman) Underwood, *Diplopterygium pinnatum* (Kunze) Nakai, *Athyrium* sp., *Diplazium* sp., *Sadleria* spp., and *Cibotium* spp. Threats include invasion by alien plant species, notably *Psidium cattleianum* Sabine, *Melastoma candidum* D. Don, and *Rubus rosifolius* Smith, and landslides. Associated *Dubautia* species include *D. imbricata* St. John & G. Carr subsp. *imbricata*, *D. laxa* subsp. *hirsuta*, *D. paleata* A. Gray, *D. pauciflorula* St. John & G. Carr, and *D. raillardioides*.

Affinities. This new species belongs to *Dubautia* sect. *Dubautia*, characterized by mesomorphic leaves lacking a distinct petiole, blades not visibly reticulate or with areolae obviously longer than broad, and pappus paleae or aristae laciniate-fimbriate or minutely ciliate with fimbriae or cilia less than 0.4 mm long. *Dubautia syndetica* was first thought to represent an isolated primary hybrid between *D. laxa* subsp. *hirsuta* and *D. raillardioides*. Indeed, several features of the new species suggest this origin. For example, it combines the peduncular glands found in *Dubautia raillardioides* with the corolla glands found in *D. laxa* subsp. *hirsuta*. Other features of *Dubautia syndetica*, including the color, shape, distribution, texture, and coalescence of the receptacular bracts, the color and texture of the pappus, the indumentum of the peduncles, leaves, and achenes, and the general habit of the plants, also appear to be intermediate to the corresponding features of *Dubautia laxa* subsp. *hirsuta* and *D. raillardioides*.

While many features of *D. syndetica* appear intermediate to the putative parental species, leaf venation is very similar to that of *D. laxa* subsp. *hirsuta*, and leaf size (especially on flowering shoots) is smaller than might be expected in the hypothesized hybrid combination. In any case, the frequency and distribution of plants in the field are indicative of a reproductively stabilized taxon, not a series of primary F_1 hybrids. Thus, formal taxonomic recognition is desirable. The specific epithet, derived from the Greek *συνδετικοσ* (binding together), recalls the striking combination of features of two other species of *Dubautia*, and bespeaks the putative hybrid nature of this taxon.

Paratypes. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Koloa District, Kanaele Swamp drainage, along main fork and upper tributaries of Wahiawa Stream to crest of ridge just SW of Kapalaoa, 670–975 m, 13 Apr. 1991, *Flynn et al. 4589* (BISH, PTBG), 700 m, 1 June 1995, *Morden et al. 1380*, (BISH), 715 m, 1 June 1995, *Carr et al. 1501* (BISH, HAW); Wahiawa Stream drainage, SW of Kapalaoa, 730–850 m, 20 Apr. 1991, *Flynn et al. 4625* (PTBG); W side of Wahiawa Stream drainage, gulch between Lone Loulu Ridge and LZ1, 700–770 m, 23 July 1991, *Wood et al. 1085* (PTBG); Wahiawa Mts. just NE of Wahiawa Bog, along main Wahiawa Stream, NW of Mt. Kahili, 630–740 m, 12 Apr. 1988, *Lorence et al. 5962* (PTBG); ESE of main Wahiawa Stream heading up 2 unnamed gulches to ridge connecting Kahili and Kapalaoa Peaks, 29 Jan. 1991, *Lorence et al. 6694* (BISH); on windward side of ridge between Relay Towers and Mt. Kahili, ca. 685 m, 6 June 1985, *Flynn 1116* (BISH, PTBG); Lihue District, Kapalaoa Peak, windswept ridge, 915–930 m, 15 May 1991, *Wood et al. 840-C* (PTBG).

Acknowledgments. We would have little to write about if it were not for tireless botanical explorers who often risk much to bring back interesting new collections. We especially thank Tim Flynn, Steve Perlman, and Ken Wood, who have each contributed to a better understanding of this and many other Hawaiian plants.

Literature Cited

Baldwin, B. G. 1997. Adaptive radiation of the Hawaiian silversword alliance: Congruence and conflict of phylogenetic evidence from molecular and non-molecular investigations. Pp. 103–128 *in* T. J. Givnish & K. J. Sytsma (editors), Molecular Evolution and Adaptive Radiation. Cambridge Univ. Press, Cambridge.

——— & R. H. Robichaux. 1995. Historical biogeography and ecology of the Hawaiian silversword alliance (Asteraceae). Pp. 259–287 *in* W. L. Wagner & V. A. Funk (editors), Hawaiian Biogeography. Smithsonian Institution Press, Washington, D.C.

———, D. W. Kyhos, J. Dvorak & G. D. Carr. 1991. Chloroplast DNA evidence for a North American origin of the Hawaiian silversword alliance (Asteraceae). Proc. Natl. Acad. U.S.A. 88: 1840–1843.

Carlquist, S. 1970. Hawaii, a Natural History. Natural History Press, Garden City, New York.

———. 1974. Island Biology. Columbia Univ. Press, New York.

Carr, G. D. 1985. Monograph of the Hawaiian Madiinae (Asteraceae): *Argyroxiphium*, *Dubautia*, and *Wilkesia*. Allertonia 4: 1–123.

———, B. G. Baldwin & D. W. Kyhos. 1996. Cytogenetic implications of artificial hybrids between the Hawaiian silversword alliance and North American tarweeds (Asteraceae: Heliantheae–Madiinae). Amer. J. Bot. 83: 653–660.

———, R. H. Robichaux, M. S. Witter & D. W. Kyhos. 1989. Adaptive radiation of the Hawaiian silversword alliance (Compositae–Madiinae): A comparison with the Hawaiian picture-winged *Drosophila*. Pp. 79–97 *in* L. V. Giddings, K. Y. Kaneshiro & W. W. Anderson (editors), Genetics, Speciation, and the Founder Principle. Oxford Univ. Press, New York.

Crins, W. J. & B. A. Bohm. 1990. Flavonoid diversity in relation to systematics and evolution of the tarweeds. Ann. Missouri Bot. Gard. 77: 73–83.

Friar, E. A., R. H. Robichaux & D. W. Mount. 1996. Molecular genetic variation following a population crash in the endangered Mauna Kea silversword, *Argyroxiphium sandwicense* subsp. *sandwicense* (Asteraceae). Molec. Ecol. 5: 687–691.

Kyhos, D. W., G. D. Carr & B. G. Baldwin. 1990. Biodiversity and cytogenetics of the tarweeds (Asteraceae: Heliantheae–Madiinae). Ann. Missouri Bot. Gard. 77: 84–95.

Robichaux, R. H., E. A. Friar & D. W. Mount. 1997. Molecular genetic consequences of a population bottleneck associated with reintroduction of the Mauna Kea silversword, *Argyroxiphium sandwicense* subsp. *sandwicense* (Asteraceae). Conservation Biol. 11: 1140–1146.

———, G. D. Carr, M. Liebman & R. W. Pearcy. 1990. Adaptive radiation of the Hawaiian silversword alliance (Compositae–Madiinae): Ecological, morphological, and physiological diversity. Ann. Missouri Bot. Gard. 77: 64–72.

Witter, M. S. 1990. Evolution in the Madiinae: Evidence from enzyme electrophoresis. Ann. Missouri Bot. Gard. 77: 110–117.

Another New Species of *Dubautia* (Asteraceae–Madiinae) from Kaua'i, Hawaiian Islands

Gerald D. Carr
Department of Botany, University of Hawaii, 3190 Maile Way, Honolulu, Hawai'i 96822, U.S.A.

ABSTRACT. *Dubautia kenwoodii* G. Carr from the Hawaiian Island of Kaua'i is described and illustrated. The new species is distinguished from congeners by virtue of its combination of uniseriate, peripheral, very firmly coalescent receptacular bracts, cymose-glomerate capitula, and coriaceous, lustrous leaves with sharply cartilaginous-toothed margins and abruptly narrowed, broadly clasping bases.

Intensive botanical exploration of Kaua'i over the last several years has led to increased understanding of many plant groups and to the discovery of many species not previously known to science. For example, the publication of a new species of *Dubautia* from Kaua'i by Carr and Lorence (1998, this issue), brings the total number of species currently recognized in that genus to 22 (cf. Carr, 1985). The substantial body of new information about *Dubautia* on Kaua'i warrants a detailed reassessment of the genus on that island. However, it seems more prudent to formally recognize another new, exceedingly rare species of *Dubautia* in a timely fashion in order to encourage efforts to find additional populations of this critically endangered taxon and to make it eligible for legal protection and conservation.

Dubautia kenwoodii G. Carr, sp. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Hanalei District, Kalalau Rim, N of Kahuama'a Flat, steep, diverse Lowland Mesic Forest, 800 m, 4 July 1991. *K. R. Wood & M. Query 1004* (holotype, PTBG). Figures 1, 2.

A speciebus aliis *Dubautiae* sectionis *Dubautiae* bracteis receptaculi uniseriatis peripheralibus firmissimis coalescentibus, capitulis cymoso-glomerulatis, foliis coriaceis nitidis margine acute cartilaginidentata basi abrupte contracta differt.

Shrub 5 dm tall, vegetative stems apparently glabrous except for a tuft of trichomes on the upper border of some leaf scars, woody and brown below; flowering stems becoming increasingly hispid in the region of the capitulescence. Leaves opposite, coriaceous, commonly 4–12 cm long, 0.8–2.0 cm broad, narrowly elliptic to sometimes narrowly lanceolate, surfaces nearly concolorous in dried material, gray-green, lustrous above, only slightly paler and duller beneath, glabrous, or becoming medially hispidulous in proximity to the capitulescence; margins with very conspicuous sharply pointed, narrow, somewhat cartilaginous teeth from apex to about the middle, often ciliolate basally; apex usually slightly acuminate; base rather abruptly narrowed and somewhat broadly clasping the stem at point of insertion; venation parallelodromous, with mostly 7 basal veins visible above, sometimes with additional parallel veins and usually fainter elongate-areolate reticulations visible beneath. Heads numerous, disposed in elongate-paniculiform, cymose-glomerate congested capitulescences about 14 cm long and 10 cm broad; peduncles increasingly hispidulous above, the ultimate ones mostly less than 1 mm long; receptacular bracts about 9–12, linear-oblanceolate, gray-green, densely hispidulous and obscurely minutely glandular, peripheral, uniseriate, the lower ⅔ very strongly and uniformly coalescent (remaining so and becoming sub-indurate on drying), forming a cone about 5 mm long, the lanceolate free tips up to 3 mm long, apparently reflexed in age; receptacle flat, moderately hirsute between the fruit scars; florets mostly 12–18, the corolla rusty yellow in age, 3.0–4.0 mm long, apparently commonly slightly exceeded by the pappus, moderately glandular on the tubular portion, rather abruptly dilated distally, ending in 5 triangular lobes about 1 mm long; pappus stramineous, comprising about 21 unequal, very narrowly linear-lanceolate, shortly fimbriate aristae 3.75–4.5 mm long; achenes conspicuously grayish-strigose, straight or only slightly curved, mostly 3.5–4.5 mm long.

Distribution. This taxon is known only from a single collection on the steep slopes of the Kalalau Rim where it was reached by rappelling. Based on extremely limited phenological data, flowering appears to occur in June.

Habitat. *Dubautia kenwoodii* is found in a diverse Lowland Mesic Forest community with *Chamaesyce eleanoriae* Lorence & W. L. Wagner, *Hed-*

Figure 1. *Dubautia kenwoodii* G. Carr. —Holotype, *Wood & Query 1004.* Bar = 5 cm.

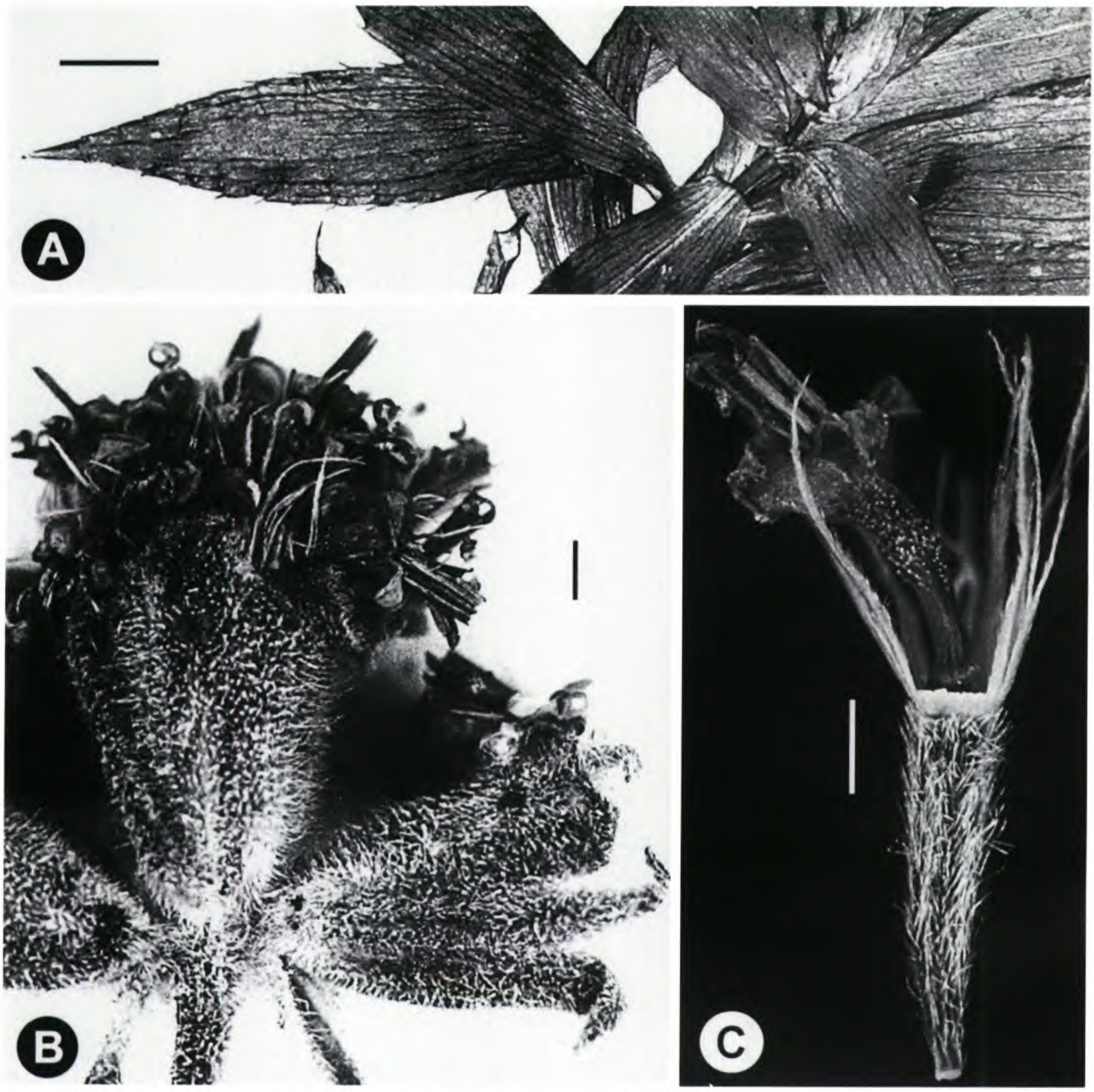


Figure 2. *Dubautia kenwoodii* G. Carr. —A. Leaves. Note especially the parallelodromous venation, the narrow, sharp teeth on the margins and the abruptly narrowed, broadly clasping bases. *Wood & Query 1004.* —B. Capitula. Note the cymose-glomerate association of heads, the firmly coalesced receptacular bracts forming a cone that encloses the disk florets, and the copiously hispidulous indumentum of the capitulescence. *Wood & Query 1004.* —C. Disk floret with several pappus aristae removed to reveal the corolla. Note the copiously hispid achene and the conspicuous sessile or short-stalked glands on the upper middle portion of the corolla tube. *Wood & Query 1004.* Bars = 1 cm in A, 1 mm in B, C.

yotis flynnii W. L. Wagner & Lorence, *Hibiscadelphus woodii* Lorence & W. L. Wagner, *Lobelia niihauensis* St. John, *Lysimachia* spp., *Melicope pallida* (Hillebrand) T. Hartley & B. Stone, *Nototrichium divaricatum* Lorence, *Poa mannii* Munro ex Hillebrand, and *Stenogyne campanulata* Weller & A. Sakai. Threats include the extremely small population size of one known individual, invasion by alien plant species, and nearby severe disturbance by goats and pigs. The threats at this locality are discussed in greater detail by Lorence and Wagner (1995).

Affinities. This new species belongs to *Dubautia* sect. *Dubautia*, generally characterized by mesomorphic leaves lacking a distinct petiole, blades not visibly reticulate or with areolae obviously longer than broad, and pappus paleae or aristae laciniate-fimbriate or minutely ciliate with fimbriae or cilia less than 0.4 mm long. However, the coriaceous leaves of *D. kenwoodii* are unusual for members of section *Dubautia*. Moreover, although some degree of coalescence of receptacular bracts occurs in a few other species of *Dubautia* sect. *Dubautia*,

in none of these is this coalescence as firm and as persistent as that observed in the capitula of *Dubautia kenwoodii*. In contrast, all members of *Dubautia* sect. *Railliardia* (Gaudichaud) G. Carr have firmly coalescent receptacular bracts and several also have coriaceous leaves. Thus, the features of *Dubautia kenwoodii* further blur the distinction between sections *Dubautia* and *Railliardia*, making their former treatment as distinct genera even less tenable than previously thought (cf. St. John, 1950; Carr, 1985).

Dubautia kenwoodii appears to be most closely related to *D. laevigata* A. Gray. Similarities include the nature of the indumentum and construction of the capitulescence, the luster of the upper leaf surface, and the pronounced sharp teeth on the leaf margins. These species also have a similar elongate areolate-reticulate venation visible on the lower leaf surfaces, although this pattern is much finer, and is more uniform and pronounced in *D. laevigata* than it is in *D. kenwoodii*. In contrast, the leaves of *D. kenwoodii* are markedly more coriaceous and lack the long slender petioloid base that is so characteristic of *D. laevigata*. Furthermore, the firmly coalescent receptacular bracts of *D. kenwoodii* contrast with the essentially distinct receptacular bracts of *D. laevigata*.

Acknowledgments. This species is named for Ken Wood, its discoverer, and possibly the only person to see it in situ. The author is grateful to David H. Lorence for reviewing an early draft of the manuscript and providing the Latin version of the diagnosis.

Literature Cited

Carr, G. D. 1985. Monograph of the Hawaiian Madiinae (Asteraceae): *Argyroxiphium*, *Dubautia*, and *Wilkesia*. Allertonia 4: 1–123.

——— & D. H. Lorence. 1998. A new species of *Dubautia* (Asteraceae–Madiinae) from Kaua'i, Hawaiian Islands. Novon 8: 4–7.

Lorence, D. H. & W. L. Wagner. 1995. Another new, nearly extinct species of *Hibiscadelphus* (Malvaceae) from the Hawaiian Islands. Novon 5: 183–187.

St. John, H. 1950. The subgenera of *Dubautia* (Compositae): Hawaiian Plant Studies 18. Pacific Sci. 4: 339–345.

A New Species of *Zamia* (Zamiaceae) from Ecuador

Calaway H. Dodson
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. A new species in the genus *Zamia* (Zamiaceae), *Z. gentryi*, from northwestern Ecuador is described. This arborescent species appears to be most closely allied to *Z. roezlii* Linden, with which it grows sympatrically along the margins of the populations. *Zamia gentryi* is occasionally found growing as an epiphyte. Character states that distinguish the two species are presented.

The genus *Zamia* is restricted to the tropics and subtropics of the Western Hemisphere, where about 55 species are recognized as valid. Another five (or more) species are recognized but have not been formally described. Four species have been reported from Ecuador with *Z. amplifolia* Hort ex Masters, *Z. lindenii* Regel ex Andre, and *Z. roezlii* Linden known from the western side, and *Z. ulei* Dammer vel aff. from the Amazon drainage. *Zamia poeppigiana* Martius & Eichler has been reported from southeastern Ecuador but no specimens have been seen. Some cycad specialists consider *Z. lindenii* to be synonymous with *Z. poeppigiana*. I do not consider them to be the same.

Zamia gentryi Dodson, sp. nov. TYPE: Ecuador. Esmeraldas: km 18 Lita to San Lorenzo, near Alto Tambo, 78°30′W, 00°47′N, (male plant), 800 m, 19 July 1988, *C. H. Dodson & A. H. Gentry 17520A* (holotype, QCNE; isotypes, AAU, MO, NY, RPSC, SEL, U). Figure 1A–F.

Haec species *Z. roezlii* affinis sed foliolis flavovirentibus, venatione infra glabra nonprotuberanti, microstrobilo rubiginoso, pedunculo decumbenti, megastrobilo cupiformi, megasporphyllis extus villosis differt.

Stems to 1 m or more long, recumbent if terrestrial, U-shaped if epiphytic, to 12 cm diam., in cultivation to 25 cm diam. Leaves 5 to 9 (to 13 in cultivation), stiffly erect to arching; emerging bright reddish green, turning pale yellow-green on both sides with age, to 2.5 m long; petiole 45–90 cm long, armed with stout, terete spines to 1 cm long; leaflets opposite to subopposite, narrowly ovate, somewhat oblique, lightly falcate, to 40 cm long, 3.5 to 6 cm wide, apex acute, margin entire, base attenuate; veins obvious, parallel, sunken into the surface on both sides of the leaflet; cataphylls fleshy, elongate-triangular, those preceding cone formation with a long, twisted, acuminate apex, to 12 cm long. Microsporangiate strobili 1–7, peduncle decumbent, flattened-cylindrical, to 25 cm long, fertile portion erect, wine-red, to 35 × 3.8 cm; microsporophylls hexagonal, spirally arranged, with smooth, quadrate, dome-shaped, wine-red apices; sporangia all located on the abaxial surface. Megasporangiate strobili 1 per plant, red-brown, barrel-shaped, to 30 cm long and 15 cm diam. when mature; megasporophylls hexagonal with a short, apical, hexagonal annulus, completely red-brown-villose over the exposed surface, arranged in 7–10 overlapping ranks, with 12–30 per row. Seeds obovoid, sometimes slightly 3-lobed, to 3.5 × 1.7 cm, sarcotesta pink to reddish at maturity.

Named to honor the late Alwyn H. Gentry, who participated in the collection of the type specimen. Dr. Gentry was a close friend whose knowledge and capacity for imparting his enthusiasm are sorely missed.

Distribution and ecology. *Zamia gentryi* appears to be restricted to extremely wet, premontane pluvial forest in the Provinces of Carchi and Esmeraldas in northwestern Ecuador at elevations from 300 to 1800 m. The region is poorly known botanically, and the distribution of the species is probably much more extensive, entering into similar habitat in southwestern Colombia. The soils around Alto Tambo are almost pure kaolin, extremely compact, and nonabsorbent. Some plants are encountered growing as epiphytes. Those growing on the surface of this soil do not have the trunk extended into the kaolin but rather are lying on the surface with the roots disseminated into the thin topsoil covering the kaolin. Plants growing on the forest floor are in dense shade. Rainfall at Alto Tambo has been recorded at 6500 mm per year.

Plants of *Zamia gentryi* and *Z. roezlii* occur sympatrically between km 35 (400 m) and km 41 (300 m) on the road from Lita to San Lorenzo. No suggestion of hybridization was encountered. Cones begin to emerge in both species in December with the beginning of heavy rains. Male cones take about 90 days to mature and female cones become receptive by spreading of the megasporophylls about 90

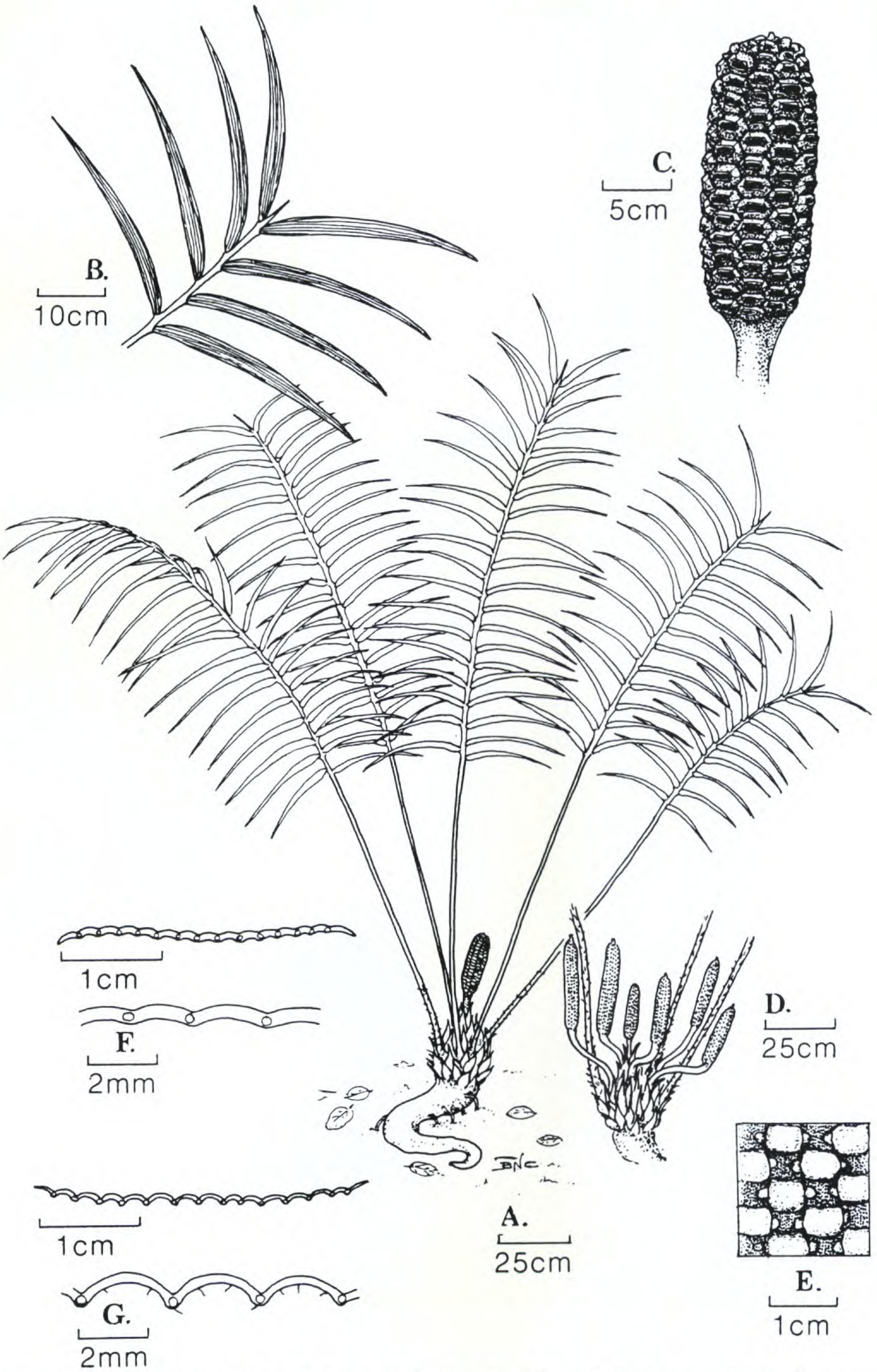


Figure 1. A–F. *Zamia gentryi* Dodson (*Luther et al. 1235*). —A. Habit. —B. Leaf apex. —C. Female cone. —D. Male cones. —E. Microsporophylls. —F. Cross section of leaflet. —G. *Zamia roezlii* Linden (*Dodson & A. H. Gentry 19048*). Cross section of leaflet.

days after emergence. Seed ripens in about a year. No noticeable fragrance was emitted from either male or female cones of either species at anthesis. No beetles were found visiting male cones of plants cultivated at the Rio Palenque Science Center. Beetles are common at that site visiting the powerfully fragrant cones of *Z. lindenii* Regel produced by plants natural to the locality.

Paratypes. ECUADOR. **Carchi:** Canton Tulcan, Tobar Donoso, Reserva étnica Awá, 78°25′W, 00°53′N, (female plant), 1800 m, 17–27 Aug. 1992, *G. Tipaz, M. Tirado, C. Aulestia, N. Gale & P. Ortiz 1878* (QCNE). **Esmeraldas:** Km 18, Lita to San Lorenzo, 78°30′W, 00°47′N, (plant sterile), 800 m, 12 Jan. 1991, *B. Øllgaard, J. Korning & K. Krogstrup 98726* (AAU, QCNE), km 16, (female plant), 750–850 m, *C. Dodson, H. van der Werff & W. Palacios 17107* (QCNE), (female plant), 3 Sep. 1993, *C., P. M. & T. Dodson 19098* (QCNE), (female plant), 22 Feb. 1988, *H. Luther, J. Kress & Roesel 1235* (SEL).

Features that Distinguish *Z. gentryi* and *Z. roezlii*

DISTRIBUTION

Zamia gentryi: Northwestern Ecuador at elevations from 300 m to 1800 m. *Zamia roezlii:* Coastal Colombia south to northwestern Ecuador at elevations from sea level to 300 m (in Ecuador).

PLANT HABIT

Zamia gentryi: In wild plants the stem reaches 1 m long and 12 cm in diameter, but lies on the surface of the ground or if epiphytic has a characteristic U-shape. In cultivated plants growing in open sunlight the stems may be partially erect, to 70 cm tall and 25 cm in diameter. *Zamia roezlii:* Stiffly erect to 5 m tall (occasionally recumbent after falling over) and 30 cm in diameter.

LEAVES

Zamia gentryi: From 5 to 13 on mature plants, stiffly erect-spreading. *Zamia roezlii:* From 15 to 45 on mature plants, erect-spreading to slightly curved.

LEAFLETS

Zamia gentryi: Leaflets pale yellow-green on both surfaces. Veins evident but immersed in the tissue of the leaflet surface, completely glabrous (Fig. 1F). *Zamia roezlii:* Dark green on the upper surface, pale green on the under surface. Veins on the under surface prominent and well-protuberant, with scattered red-brown trichomes to 0.5 mm long on the veins and occasionally between the veins (Fig. 1G).

MALE CONES

Zamia gentryi: Peduncles recumbent, produced from the trunk apex, to 20 cm long; the fertile portion erect, to 35 cm long and 3.8 cm in diameter, wine-red. Microsporophylls with a wine-red exposed outer surface. *Zamia roezlii:* Erect from the trunk apex, the peduncle straight or only slightly curved, to 30 cm long; the fertile portion to 40 cm long and 6 cm in diameter, pale pinkish gray. Microsporophylls pinkish gray on the exposed outer surface.

FEMALE CONES

Zamia gentryi: Barrel-shaped to cylindrical to 30 cm long when mature, red-brown. Megasporophylls completely covered with dense, villose, red-brown trichomes on the exposed outer surface, the hexagonal, slightly-raised margin villose. Seeds covered in a pink to red, fleshy sarcotesta, the seeds to 3.5 cm long and to 1.7 cm in diameter. *Zamia roezlii:* Cylindrical to 90 cm long when mature, red-brown. Megasporophylls with the hexagonal, raised margin glabrous and the concave cavity in the center hirsute. Seeds covered in an orange-red, fleshy sarcotesta, the seeds to 3.3 cm long and to 1.5 cm in diameter.

Specimens of Zamia roezlii *studied:* COLOMBIA. Near Buenaventura, cultivated at Fairchild Tropical Gardens, 3 plants grown at RPSC, *Dodson 19453* (RPSC). ECUADOR. **Esmeraldas:** near San Lorenzo, 4 plants cultivated at RPSC, *Dodson 19622* (RPSC); km 41, Lita to San Lorenzo, (male plant), 78°31′W, 00°47′N, 300 m, 6 May 1993, *Dodson & T. Neudecker 19083* (QCNE, RPSC), km 35, (female plant), 400 m, *Dodson & A. H. Gentry 19048* (RPSC); Eloy Alfaro, Reserva Ecológica Cotacachi-Cayapas, Paroquia Luis Vargas Torres, Río Santiago, Estero Angostura, (female plant), 78°45′W, 00°49′N, 250 m, 28–31 Oct. 1883, *M. Tirado, P. Asimbaya, M. Oroso & J. Arroyo 646* (QCNE); San Lorenzo, Reserva Étnica Awá, Centro Ricaurte, (sterile plant), 78°32′W, 01°10′N, 300 m, 28 Oct. 1992, *G. Tipaz, C. Aulestia & F. Pascal 2242* (QCNE); Eloy Alfaro, Comuna Corriente Grande, Río Chimbagal, (sterile plant), 78°50′W, 00°41′N, 300 m, 7 Aug. 1993, *A. Yanez, M. Chapiro & M. de la Cruz Añapa 1413* (QCNE).

Acknowledgments. Gratitude is expressed to Carlyle Luer for preparation of the Latin diagnosis.

New Species and New Combinations of *Urtica* (Urticaceae) from South America

Dmitry V. Geltman

Herbarium, Komarov Botanical Institute, Prof. Popov Street 2, St. Petersburg 197376, Russia

ABSTRACT. Two new species, *Urtica peruviana* and *U. pseudomagellanica*, are described from Peru and Bolivia, respectively. Also, the new combinations *U. lilloi* (Hauman) Geltman and *U. magellanica* subsp. *bracteata* (Steudel) Geltman are made.

The genus *Urtica* includes about 70 species that are distributed in temperate regions of the Northern and Southern Hemispheres and at high elevations in the tropics.

The most significant taxonomic characters in the genus are those of life forms, inflorescences, leaf blade, stipules, indumentum, and characters of the fruits. The majority of *Urtica* species are annual and perennial herbs, but a few are shrubs and small trees.

Almost all species (except for a few specialized ones, such as *U. glomeruliflora* Steudel and *U. pilulifera* L.) have two main types of inflorescence. It is necessary to clarify the terminology of inflorescence morphology used below. In general I follow that of Golenkin (1894, 1895), who made a considerable contribution to the understanding of the nature of Urticaceae inflorescences. The first type I name "dichasium-like inflorescence"; the same type was named by Golenkin as "modified dichasium." Such inflorescences are usually shorter than the petioles of adjacent leaves and are characteristic of such well known species as *Urtica urens* L. Inflorescences of the second type, which I name "thyrsoid," have a monopodial axis (branching as in *U. dioica* L. or nonbranching as in *U. membranacea* Poiret) bearing small dichasial clusters of flowers. Golenkin named such inflorescences as "dorsiventral," but, following more modern terminology (Troll, 1964), they should be referred to as a "thyrsus." Usually such inflorescences are longer than the petioles of adjacent leaves. It is also significant that the inflorescences are unisexual or androgynous. Characters of inflorescences are often significant for delimitation of taxa at sectional and subsectional levels; this is especially true for species distributed in the Northern Hemisphere. However, in South America such characters are essential for delimitation at the species level.

Shape and size of the leaves are significant mostly at the species level. It is also necessary to mention that most *Urtica* species usually have smaller leaves at upper nodes and larger ones at lower nodes. To facilitate comparison with other species, all leaf measurements below are for leaves at the lowermost nodes bearing inflorescences. Stipules can be connate or free, which, together with their form, is taxonomically significant. *Urtica* species normally have cystoliths (visible mainly on the upper surface of the leaf blade) and their form is often also of taxonomic significance.

The indumentum of *Urtica* species consists of stinging and nonstinging hairs. Each type of hair represents an independent taxonomic character. Stinging hairs are always present at stem nodes, on petioles, and at inflorescence axes but can be absent from leaf blades. A special case is the presence of stinging hairs on the calyx lobes. When using the terms "pilose," "pubescent," or "glabrous" I have in mind presence or absence of nonstinging hairs only.

During work on a revision of South American *Urtica*, several specimens could not be referred to known taxa and certainly represent new species.

Urtica peruviana Geltman, sp. nov. TYPE: Peru. Depto. Cajamarca: prov. Contumazá, El Tunel (Cascas–Contumazá), 2700 m, *Sagastegui, Guzmán, Leiva & Tellez 12630* (holotype, MO!). Figure 1.

Ab *Urtica leptophylla* Kunth inflorescentiarum axibus ramificantibus differt, ab *Urtica macbridei* Killip inflorescentiis androgynis (non unisexualibus) ramificantibus dignoscitur.

Perennial herb ca. 1 m. Stems erect, with a few stinging and nonstinging hairs, sometimes almost glabrous. Leaf blades on petioles 1–3 cm, ovate or ovate-cordate, 6–8 cm long and 3–5 cm wide, apex acuminate, base cordate or rounded, margin dentate-crenate with 20–30 teeth on one side of leaf, bearing a few stinging hairs on the upper surface and scattered nonstinging hairs on both sides, but mainly on nerves beneath; cystoliths mainly punctiform, rarely oblong. Stipules connate in pairs at

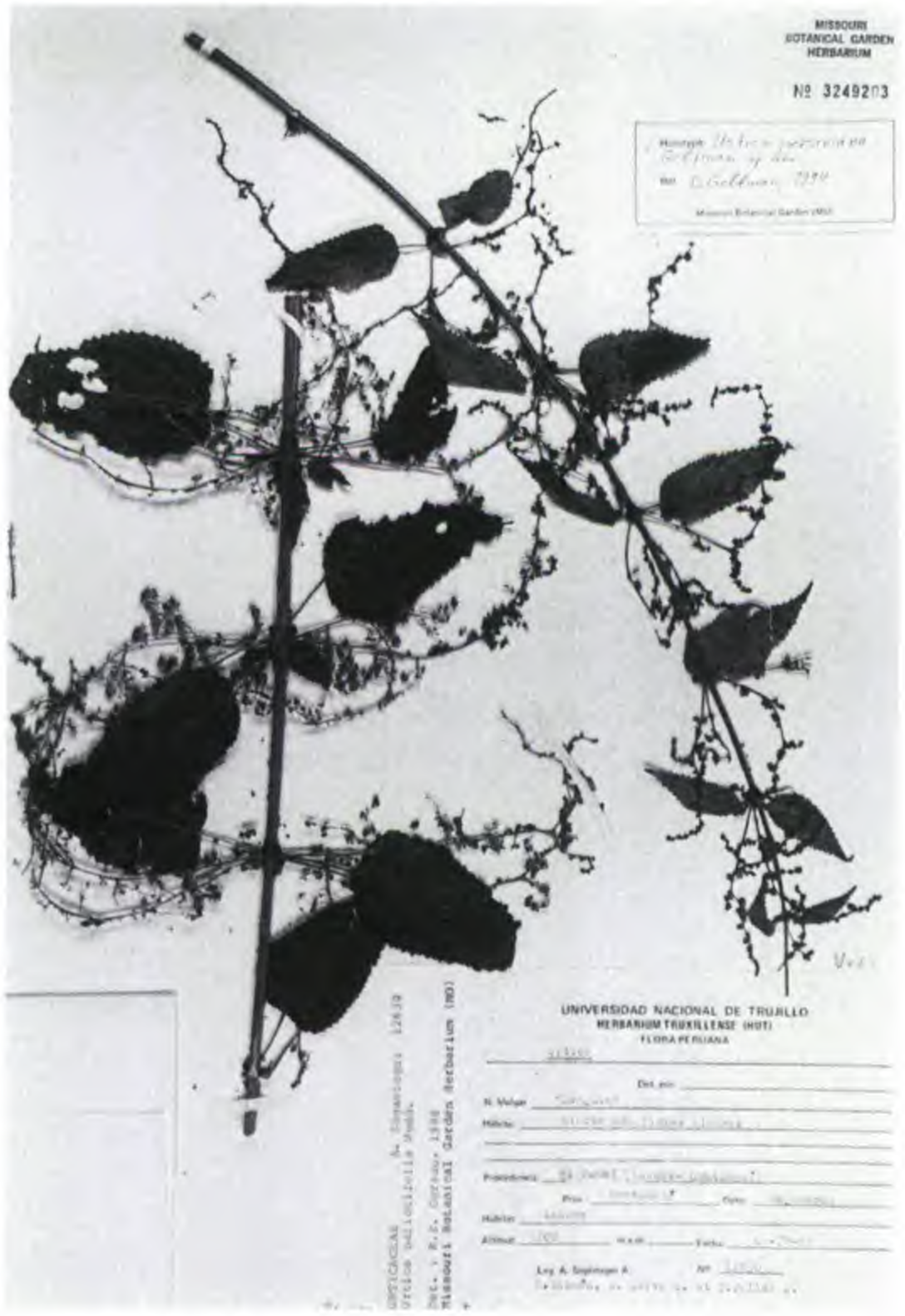


Figure 1. Holotype of *Urtica peruviana*.

Figure 2. Holotype of *Urtica pseudomagellanica*.

least on ¾ of their length, ovate-oblong, 5–7 mm long, adpressed pilose. Inflorescences axillary, androgynous (sometimes inflorescences at upper nodes predominantly pistillate, at lower nodes predominantly staminate), thyrsoid, with branching axes, at least at median and lowermost nodes, nearly the same length as the leaves or longer. Enlarged (dorsal) calyx segments of pistillate flowers pilose, without stinging hairs, in fruit two times longer than the lateral segments. Fruits suborbicular to ovate, often with a short apical nozzle, 1.5–1.7 mm long, 1.3–1.7 mm wide.

Urtica peruviana is known only from Peru, from the vicinity of Guzmango (Depto. Cajamarca, prov. Contumazá), and probably is locally endemic.

This species in general habit and especially in leaf blade shape resembles *Urtica leptophylla* Kunth (syn. *U. ballotaefolia* Weddell) and *U. macbridei* Killip. However, it differs from the former in having inflorescences with branching axes, and from the latter in having androgynous (not unisexual) inflorescences. Clearly, these three species, along with *U. longispica* Killip, are closely related and should be referred to the same section. This is an unusual case in the genus: as mentioned above, Old World sections and subsections, as a rule, differ mainly by inflorescence structure.

Paratypes. PERU. **Cajamarca:** 2600 m, *Sagastegui & Samame 2935* (NY); alrededores de Guzmango, 2500 m, *Sagastegui & Mostacero 9132* (MO), *Sagastegui et al. 9646* (MO); La Herilla (Guzmango), 2800 m, *Sagastegui et al. 9704* (MO); alrededores de Guzmango, 2400 m, *Sagastegui 11413* (MO).

Urtica pseudomagellanica Geltman, sp. nov. TYPE: Bolivia. Depto. La Paz: prov. Murillo, Zongo valley, 25.2 km below the dam of Lago Zongo, disturbed moist forest, 2700 m, *Solomon 13101* (holotype, MO!; isotype, LPB). Figure 2.

Haec species *Urticae echinatae* Bentham et *Urticae magellanicae* Poiret ex parte similis, segmentis calycis florum pistillorum fere glabris pilum unum urticantem ferentibus differt. Ab *Urtica lilloi* (Hauman) Geltman inflorescentiarum axibus dichasialibus crassiusculis, non filiformibus thyrsoideis dignoscitur.

Perennial herb 30–100 cm tall. Stems erect, mostly solitary, with scattered stinging hairs, almost without nonstinging hairs. Leaves opposite, with petioles 1.7–4.5 cm long, ovate, 9–11 cm long and 3–7 cm wide, apex acuminate, base rounded or cuneate, margin dentate with 17–19 pairs of teeth,

from almost glabrous to sparsely pilose, with scattered stinging hairs mainly on upper surface; cystoliths punctiform. Stipules free, oblong-triangular, 3–5 mm long, sparsely pilose at margin. Inflorescences axillary, androgynous, with dichasium-like branched axes, shorter than petioles (at upper nodes sometimes equal to or slightly longer than petioles). Enlarged (dorsal) calyx segments of pistillate flowers almost glabrous, with a single stinging hair on each, in fruit ca. 2 times longer than lateral segments. Fruits elliptic or ovate, 1.2–1.3 mm long and 0.7–0.9 mm wide.

Known from Bolivia, La Paz department, and two collections (unfortunately, with poorly developed inflorescences, so determination is provisional) from west Santa Cruz and Tarija departments. Grows at 2700–3300 m in forests, often on disturbed soils.

This species resembles *Urtica magellanica* in general habit, but has a different inflorescence structure (dichasium-like, not thyrsoid) and mostly punctiform rather than linear cystoliths. It can be easily distinguished from *U. magellanica* and large specimens of *U. echinata* by the almost glabrous dorsal calyx segments of pistillate flowers each with a single stinging hair. From *U. lilloi*, which is also characterized by this feature, it can be distinguished by the usually shorter inflorescences with incrassate, not thin axes.

Paratypes. BOLIVIA. **La Paz:** Valle de Corani, *Adolfo 412* (US); Unduavi, Nord-Yungas, 3300 m, *Buchtien 2817* (NY, US); Unduavi, 8000 ft., *Rusby 1256* (NY, US); Valle del Río Zongo, 26.4 km al N de la cumbre, bosque humedo, disturbido, 2750 m, *Solomon 17482* (LPB, MO). **Santa Cruz:** ca. 19 km W of Comarapa on Carretera Fundamental 4, ca. 8400 ft., *Davidson 3849* (MO). **Tarija:** Toldos bei Bermejo, 1900 m, *Fiebrig 2233* (G, K).

In the process of revision I also decided to change the status of two existing taxa in the genus.

Urtica lilloi (Hauman) Geltman, stat. et comb. nov. Basionym: *Urtica magellanica* Poiret subsp. *lilloi* Hauman, Anales Mus. Nac. Hist. Nat. Buenos Aires, 32 (Cat. Phan. Argentine, 2): 415. 1925. TYPE: Argentina. Tucumán: Siambón, El Matadero, alt. 1100 m, *Lillo 1042* (holotype, LIL not seen).

This taxon certainly merits species rank. It differs from *Urtica magellanica* in having inflorescences with branching axes and the dorsal calyx segments of pistillate flowers almost glabrous, bearing only a single stinging hair; typical *U. magellanica* has inflorescences with nonbranching axes and calyx segments bearing only nonstinging hairs. In general habit *U. lilloi* resembles *U. incisa* Poiret, distributed in New Zealand, Tasmania, and South Australia, but differs in the androgynous rather than unisexual inflorescences and the form of the leaves.

Urtica magellanica Poiret subsp. **bracteata** (Steudel) Geltman, stat. et comb. nov. Basionym: *Urtica bracteata* Steudel, Flora 33: 258. 1850. *Urtica magellanica* var. *bracteata* (Steudel) Weddell, in DC. Prodr. 16 (1): 47. 1869. TYPE: Ad sepes secus vias Rancagua Chili, *Bertero 737* (lectotype, designated by Geltman (1994), P).

Similar to the typical subspecies in general habit, but differing in having the stipules of the upper node connate at the base in pairs and in the inflorescence structure. Typically in *Urtica magellanica* inflorescences are androgynous throughout. However, in subspecies *bracteata* the inflorescences at the upper nodes are only pistillate, those at lower nodes are androgynous or sometimes staminate.

This subspecies has a restricted distribution, occurring only in Chile, mostly in Regions IV, V, and Metropolitana (isolated locality found in Region IX—Isla Mocha), while the typical subspecies ranges from southern Chile and Argentina to Bolivia and Peru.

Acknowledgments. Support for my studies on the taxonomy of Latin American *Urtica* has been provided by the Missouri Botanical Garden and is gratefully acknowledged. I am also grateful to Roy Gereau for reviewing the Latin diagnoses and to James Solomon for reviewing and editing the manuscript.

Literature Cited

Geltman, D. V. 1994. Lectotypification of three names in *Urtica* (Urticaceae). Novon 4: 23–24.

Golenkin, M. I. 1894. Beitrag zur Entwicklungsgeschichte der Infloreszenzen der Urticaceen und Moraceen. Flora 78: 97–132.

———. 1895. *Materialy dlia kharakteristiki sotzvetziy krapivotzvetnykh* [Materials for the characteristics of Urticales inflorescences]. Uchen. Zap. Imp. Moskovsk. Univ., Otd. Estestv.-Istorich. 12: 4–80. [In Russian.]

Troll, W. 1964. Die Infloreszenzen. Jena: Fischer Verlag. Bd 1. 615 S.

A New Narrow, Endemic Species of *Pritchardia* (Arecaceae) from Kaua'i, Hawaiian Islands

Chrissen E. C. Gemmill

Department of Environmental, Population, and Organismic Biology, University of Colorado, Campus Box 334, Boulder, Colorado 80309-0334, U.S.A.

Current Address: Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton, New Zealand. E-mail: c.gemmill@waikato.ac.nz

ABSTRACT. A new, endemic species of the Pacific palm genus *Pritchardia* is described. *Pritchardia perlmanii* is distinct morphologically from all other *Pritchardia* species by the combination of medium stature, tomentose petioles and prophylls, abaxially glabrous to sparsely lepidote leaf blades, glabrous inflorescences with two orders of branching, and obovoid to pyriform fruits. Like many other Hawaiian species of *Pritchardia*, *P. perlmanii* has no sympatric congeners, is restricted to a single valley, and is vulnerable to extinction.

The genus *Pritchardia* Seemann & H. Wendland is distributed in Fiji, Tonga, the Tuamotu Archipelago, Cook Islands, and the Hawaiian Islands (Uhl & Dransfield, 1987; Read & Hodel, 1990; Dransfield & Ehrhart, 1995). *Pritchardia* is the only genus of palms native to the Hawaiian Archipelago and represents one of the most species-rich lineages of the Hawaiian flora (Fosberg, 1948; Wagner et al., 1990). The Hawaiian Islands species, known in Hawaiian as "loulu," are all single-island endemics, many restricted to single localities. Eight species currently are listed or proposed as federally endangered (FWS, 1992, 1994, 1996). Here I describe a new species known only from Wai'oli Valley, Kaua'i; with the publication of this species the total number of recognized Hawaiian species of *Pritchardia* is 23, with 1 each from Nihoa, Ni'ihau, and Lāna'i, 3 each from O'ahu, Moloka'i, and Maui, 4 from Hawai'i, and 7 from Kaua'i. Also, two more potentially new Kaua'i species are currently under study, one each from the Makaleha Mountains and the Wahiawā Bog area (Gemmill, pers. obs.; D. Lorence, National Tropical Botanical Garden, NTBG, pers. comm.).

This distinctive palm was collected from Wai'oli Valley, Kaua'i, for the first time by S. Perlman and K. Wood on 30 December 1991, and soon after by K. Wood and M. Query. A subsequent botanical survey of the upper Wai'oli Valley by T. Flynn, D. Lorence, S. Perlman, and K. Wood, all of the NTBG, led to the discovery of other individuals referable to this species, but only within Wai'oli Valley (Lorence & Flynn, 1993).

Pritchardia perlmanii Gemmill, sp. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Hanalei District, Wai'oli Valley, back of valley, (22°10′N, 159°30′W, UTM $^{4}48^{000m}$E, $^{24}51^{000m}$N), *Metrosideros-Dicranopteris-Pisonia* lowland wet forest, 300–370 m, 30 Dec. 1991, *Wood & Perlman 1545* (holotype, PTBG). Figure 1.

Arbor usque ad 10 m, petiolis 170 cm longis hinnuleotomentosis, laminis 105 cm longis, 54-segmentis, pagina abaxiali cum lepidis ellipticis 0.5 mm longis. Pedunculo 68 cm longo, tribracteato, rhachidi 32 cm, glabra, ramificatine duobus ordinibus, calycibus 5 mm longis, tridentatis, petalis 10 mm longis, antheris 4 mm longis, drupis obovoideo-pyriformibus 1.9–4.0 × 1.2–2.1 cm.

Solitary, slender, forest palms. Trunk 5–10 m tall or more, ca. 30 cm DBH, conspicuously ringed with leaf scars and bearing vertical fissures. Crown symmetrical, spherical, with 30+ leaves. Petioles ca. 170 cm long, 1.5 times as long as leaf blade, 7 cm wide at base, 2.25 cm wide at apex; base densely lanate, the indument tan to rust in color and becoming tan tomentose toward apex, extending onto hastula and ribs of leaf; adaxial hastula triangular to crescent-shaped, then with a single acuminate apex. Leaf blade costapalmate, with ca. 54 segments; central portion of blade stiff, ca. 105 cm from tip of hastula to apex of median segment; largest segments 2.5 cm wide, intersegmental fibers lacking; smaller segments adjacent to petiole ± drooping; blade surface glabrous to glaucous adaxially, abaxially glabrous to dotted with minute, tan, elliptical scales, 0.5 mm long. Inflorescences one per leaf axil, erect to arcuate, shorter than petiole, ca. 100 cm long; prophyll tomentose, disintegrating; peduncular bracts three, one basal and two distal, these nearly overlapping one another, splitting into two halves, also disintegrating, glabrous adaxially, tomentose abaxially and fugacious, except along midvein, which bears lanate hairs; pe-

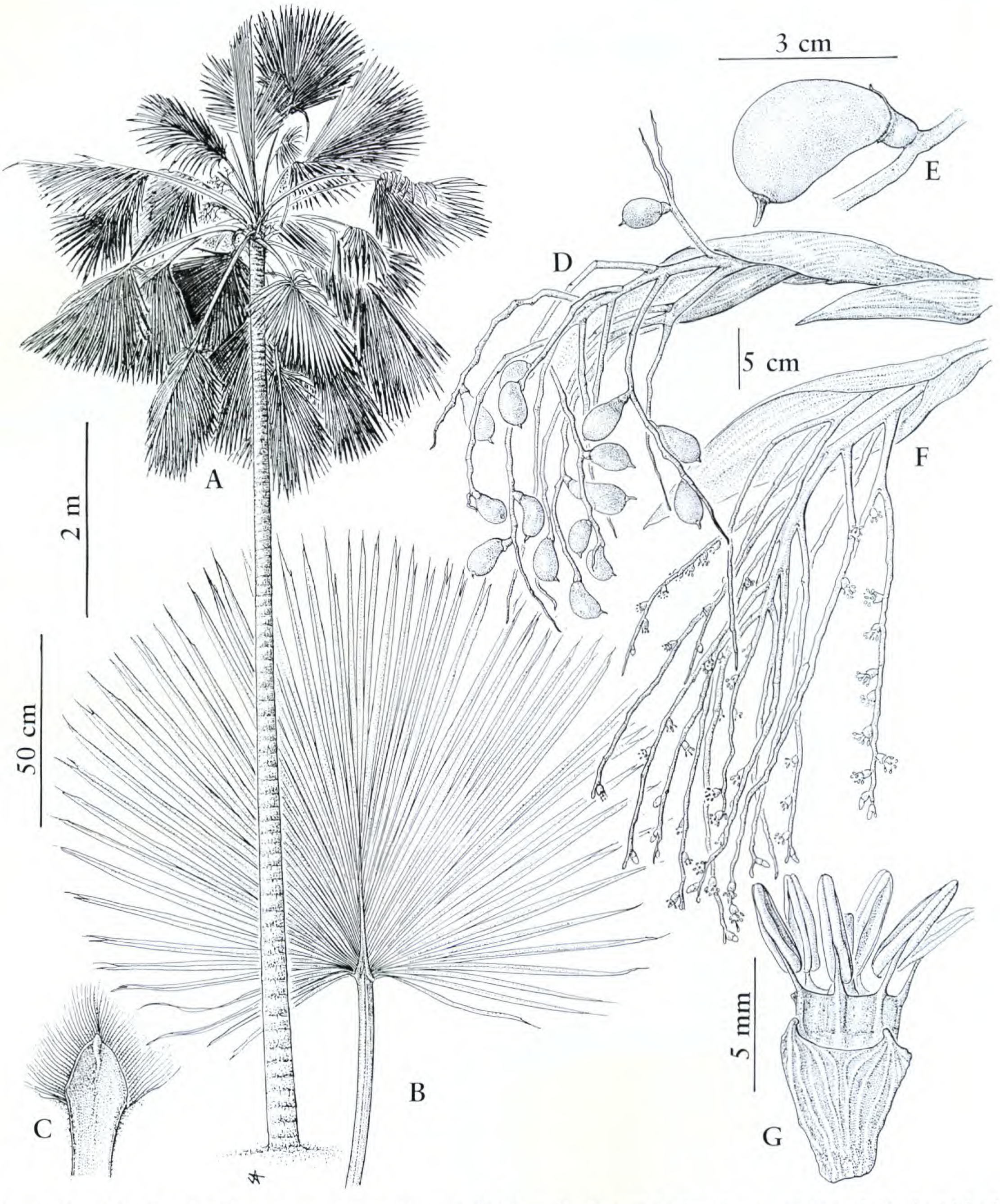


Figure 1. A–G. *Pritchardia perlmanii* Gemmill. —A. Habit. —B. Abaxial leaf surface. —C. Detail of adaxial leaf surface showing hastula. —D. Infructescence. —E. Detail of pyriform fruit, showing persistent style and cupular calyx. —F. Inflorescence. —G. Detail of post-anthesis flower.

duncle ca. 68 cm long, glabrous; rachis 32 cm long, one-third the length of the entire inflorescence, glabrous; panicle with two orders of branching, the lower branches comprising two single rachillae and one bifurcate branchlet of two rachillae, the middle branches with a single bifurcate branchlet of two rachillae, apical portion of main axis with seven to nine single rachillae; rachillae glabrous, coiled to sinuous in flower, becoming straight in fruit, 15–26 cm long. Flowers 15 mm long; calyx cupular, 5.4 × 2.0 mm, 4.5 mm wide at rim of cup, with conspicuous nerves converging in acuminate teeth 1.0 mm long; petals 10 mm long, faintly nerved when dried, apex acuminate; staminal cup exserted be-

yond calyx 1 mm; filaments 2.0 mm long; anthers 4.1 mm long; gynoecium 8.0 mm long; style 3.0 mm long, shortening as fruit develops; stigmatic tissues persistent into fruit. Fruit 1.9–4.0 × 1.2–2.1 cm, obovoid to pyriform with the basal portion tapered forming a curved, asymmetrical, thickened stalk, the calyx persistent.

Distribution, Habitat, and Ecology

Pritchardia perlmanii generally occurs on north-facing slopes and along the steep sidewalls of Wai'oli Valley, especially in hanging valleys, at elevations of 420–850 m. Population sizes range from 25 to 50 individuals, with an estimated total of 500 individuals. Both flowers and fruits have been observed in late summer (August) and winter (December and January).

These palms are found in small groves and as single individuals scattered throughout *Metrosideros polymorpha* Gaudichaud–*Dicranopteris linearis* (N. L. Burman) L. M. Underwood lowland wet forests. Other associated native species include *Alyxia oliviformis* Gaudichaud, *Antidesma platyphyllum* var. *hillebrandii* Pax & K. Hoffmann, *Bidens campylotheca* subsp. *campylotheca* C. H. Schultz, *Bobea brevipes* A. Gray, *Boehmeria grandis* (Hooker & Arnott) A. Heller, *Broussaisia arguta* Gaudichaud, *Cheirodendron trygynum* (Gaudichaud) A. Heller, *Cibotium* spp., *Cyanea recta* (Wawra) Hillebrand, *Cyrtandra limahuliensis* H. St. John, *Diplazium sandwichianum* (C. Presl) Diels, *Dubautia knudsenii* Hillebrand, *Freycinetia arborea* Gaudichaud, *Hedyotis terlminalis* (Hooker & Arnott) W. L. Wagner & Herbst, *Ilex anomola* Hooker & Arnott, *Isodendrion longifolium* A. Gray, *Joinvillea ascendens* Gaudichaud ex Brongniart & Gris, *Labordia helleri* Sherff, *Melicope* spp., *Peperomia* spp., *Perrottetia sandwicensis* A. Gray, *Pipturis* spp., *Psychotria* spp., *Sadleria* spp., *Syzygium sandwicensis* (A. Gray) Niedenzu, *Tetraplasandra* spp., *Touchardia latifolia* Gaudichaud, and *Urera glabra* (Hooker & Arnott) Weddell, with numerous pteridophytes found in the shrub layer. Alien species of concern are *Clidemia hirta* (L.) D. Don var. *hirta*, *Erechtites valerianifolia* (Wolf) DC., and *Rubus rosifolius* J. E. Smith.

Comparisons to Congeneric Species

This new species of *Pritchardia* is characterized by the combination of a slender trunk, height of 5–10 m, a large, symmetrical crown, abaxially glabrous to sparsely lepidote leaf blades, tomentose petioles and prophylls, inflorescences with two orders of branching, long, glabrous rachillae, and distinctively shaped obovoid to pyriform fruits. At least six other single-island endemic species of *Pritchardia* occur on Kaua'i: *P. waialealeana* Read (comprising common, large palms greater than 20 m in height) grows sympatrically in the Powerline Road area with *P. hardyi* Rock (rare palms with inflorescences extending beyond the crown) and *P. viscosa* Rock (endangered palms with viscous flowers and fruits and appressed lepidia on abaxial leaf surface); *P. napaliensis* H. St. John (endangered, small palms with flat leaf blades and black fruits), from the Nā Pali Coast; *P. minor* Beccari (common palms with the abaxial leaf surface densely covered with appressed lepidia), from Kōke'e State Park and the rim of Kalalau Valley; and *P. limahuliensis* H. St. John (St. John, 1988; rare, small palms with tomentose rachillae), from Limahuli Valley, the closest of these sites to Wai'oli Valley. The overall morphological characteristics of *P. perlmanii* suggest that it may be most closely related to *P. limahuliensis*. In Read and Hodel's (1990) key, which did not include *P. limahuliensis*, *P. perlmanii* comes out near *P. lowreyana* Rock from Moloka'i. Isozyme analyses (for details see Gemmill, 1996, Ph.D. Dissertation, University of Colorado, Boulder; Gemmill & Ranker, in prep.) suggest that *P. perlmanii* is most similar genetically to *P. limahuliensis* and *P. hardyi*. In comparison to *P. perlmanii*, *P. limahuliensis* has a more slender trunk, smaller crown and leaf size, and ellipsoid fruits. *Pritchardia perlmanii* is easily distinguished from *P. hardyi*, which has inflorescences that are equal to or exceed the crown, uniformly tomentose abaxial leaf surfaces, and tomentose rachillae. A dichotomous key for the seven Kaua'i species, modified from Read & Hodel (1990), is provided below.

Key to the Kaua'i Species of *Pritchardia*

1a. Inflorescences elongate, slender, greatly exceeding the petiole, nearly equaling to often extending well beyond the blade . . . . . *P. hardyi*

1b. Inflorescence short, stout, barely equaling or only slightly exceeding to much shorter than the petiole.

2a. Leaf blades abaxially densely silvery to golden appressed tomentose.

3a. Rachillae densely and loosely floccose-lanate, slender, becoming glabrate with weathering; flowers and buds dull, not shiny viscous; fruit 1–3 cm long . . *P. minor*

3b. Rachillae glabrous, viscous; flowers and buds shiny viscous; fruit 4 cm long . . . . . *P. viscosa*

2b. Leaf blades green with numerous, closely arranged, conspicuous hairs on lower surface, not densely and uniformly tomentose.

4a. Palms large, up to 20 m tall, trunk large

and stout, ca. 50 or more cm DBH; crown with more than 40 leaves; leaf blades waxy-glaucous to pale green . . . . . *P. waialealeana*

4b. Palms moderate to small, less than 10 m tall, trunk moderate to slender, much less than 50 cm DBH; crown with less than 30 or so leaves; leaf blades green.
5a. Plants 4–6 m tall; leaf blades flat, not undulate; mature fruit black . . . . . *P. napaliense*
5b. Plants to 10 m tall; leaf blades undulate; mature fruits dark green.
6a. Plants up to 10 m tall; trunk ca. 12 cm DBH; small crown with ca. 14 leaves; leaf blade ca. 80 cm; fruit ellipsoid . . . . . *P. limahuliensis*
6b. Plants 5–10 m tall; trunk ca. 30 cm DBH; full symmetrical crowns with ca. 30 leaves; leaf blade ca. 105 cm; fruit obovoid to pyriform . . . . . *P. perlmanii*

Conservation

In August 1992, S. Perlman, K. Wood, W. Hahn, and I visited a population of *P. perlmanii* located in the back of Wai'oli Valley. We found approximately 30 individuals of good health comprising mixed-stage classes of juveniles and adults; however, no seedlings were observed. This population was reduced to ca. 20 plants as a result of Hurricane 'Iniki, which passed directly over Wai'oli Valley on 11 September 1992 (Lorence & Flynn, 1993). In addition to natural disasters, alien plants and feral animals (pigs, goats, and rats) present major threats to these palms. Feral animals negatively affect these palms directly, through their impact on regeneration by eating fruits and uprooting seedlings, and indirectly, through degradation of the habitat, which increases opportunities for alien plant species to invade. These palms should receive a high priority for monitoring and feral animal eradication programs.

Although no mature individuals exist in cultivation, NTBG has propagated ex situ collections of seedlings (Accession 925007, voucher *Wood & Perlman 1545*; Accession 925163, voucher *Perlman et al. 12935*; Accession 925205, no voucher), and attempts at tissue culture of immature embryos have been conducted at Lyon Arboretum, O'ahu (S. Perlman, NTBG, pers. comm.). Because seedlings can be raised successfully under ex situ conditions, natural populations should be considered for population augmentation programs once the feral animals have been removed to the greatest possible extent. Also, this species should receive consideration for listing as federally endangered based on its status as a very narrow endemic, known from only a few highly threatened populations of very limited size.

Etymology

I am delighted to name this new species in honor of Steven Perlman, botanist, conservationist, and mentor, who brought these palms to my attention and who assisted much of my field research on Hawaiian plants.

Paratypes. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Hanalei District, Wai'oli, back of valley, 23 Jan. 1992, *Wood & Query 1594* (PTBG); Hanalei District, Halelea Forest Reserve, Wai'oli Valley, back of the valley below Namolokama Mountain, 6 Aug. 1992, *S. Perlman, K. Wood, C. Gemmill & W. Hahn 12935* (PTBG).

Acknowledgments. I sincerely thank Steven Perlman and Kenneth Wood for assistance in the field, David Lorence, Steven Perlman, Thomas Ranker, Robynn Shannon, Warren L. Wagner, William Weber, and Kenneth Wood for valuable comments on the manuscript, Donald Hodel and Michael Grayum for perceptive critical reviews, Timothy Flynn for assistance with specimen loans, Thomas Ranker and Timothy Hogan for providing work space, and John Myers for the superb illustration. This work was supported by an NSF Dissertation Improvement Research Grant (DEB-9411848) to Thomas Ranker and CECG, and by the National Tropical Botanical Garden, Lawai, Hawaii.

Literature Cited

Dransfield, J. & Y. Ehrhart. 1995. A new species of *Pritchardia* from Mitiaro, Cook Islands. Principes 39: 36–41.

Fosberg, F. R. 1948. Derivation of the flora of the Hawaiian Islands. Pp. 107–109 *in* E. C. Zimmerman (editor), Insects of Hawaii, Vol. 1. Univ. Hawaii Press, Honolulu.

FWS (U.S. Fish and Wildlife Service). 1992. Endangered and threatened wildlife and plants; Determination of endangered or threatened status for 16 plants from Molokai, Hawaii. Fed. Reg. 57: 46325–46340.

———. 1994. Endangered and threatened wildlife and plants; Determination of endangered or threatened status for 21 plants from the island of Hawaii, State of Hawaii. Fed. Reg. 59: 10305–10325.

———. 1996. Endangered and threatened wildlife and plants; Review of plant and animal taxa that are candidates for listing as endangered or threatened species. Fed. Reg. 60: 7595–7613.

Lorence, D. H. & T. Flynn. 1993. Botanical survey of upper Wai'oli Valley, Kaua'i. Final Report, Sept., 1993. Submitted to the State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife. Unpublished.

Read, R. W. & D. R. Hodel. 1990. Arecaceae. Pp. 1360–1375 *in* W. L Wagner, D. R. Herbst & S. H. Sohmer (editors), Manual of the Flowering Plants of Hawai'i,

Vol. 2. Univ. Hawaii Press and Bishop Museum Press, Honolulu.
St. John, H. 1988. Diagnoses of some phanerogramae. Hawaiian plant studies 165. Phytologia 64: 177–178.
Uhl, N. W. & J. Dransfield. 1987. Genera Palmarum. A New Classification of Palms Based on the Work of Harold E. Moore, Jr. Allen Press, Lawrence, Kansas.
Wagner, W. L., D. R. Herbst & S. H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. Univ. Hawaii Press and Bishop Museum Press, Honolulu.

New Species and Names in Ecuadorian Grasses (Poaceae)

Simon Lægaard
Herbarium AAU, Build. 137, University of Aarhus, DK 8000 Aarhus C, Denmark

ABSTRACT. Six species of grasses (Poaceae: Pooideae) from Ecuador are described as new: *Calamagrostis carchiensis*, *C. ecuadoriensis*, *C. fulgida*, *C. llanganatensis*, *C. teretifolia*, and *Poa paramoensis*; one new name is proposed: *Calamagrostis fibrovaginata*; and three new combinations are made: *Calamagrostis hirta*, *Festuca vaginalis*, and *Nassella ibarrensis*.

RESUMEN. Seis especies de gramíneas (Poaceae: Pooideae) del Ecuador se describen como nuevas: *Calamagrostis carchiensis*, *C. ecuadoriensis*, *C. fulgida*, *C. llanganatensis*, *C. teretifolia* y *Poa paramoensis*; se propone un nombre nuevo: *Calamagrostis fibrovaginata*; y se hacen tres nuevas combinaciones: *Calamagrostis hirta*, *Festuca vaginalis* y *Nassella ibarrensis*.

As a result of the listing of grass species for the forthcoming *Catalogue of Vascular Plants of Ecuador*, six new species are described, a new name is proposed to replace an illegal homonym, and three new combinations are made, all in the subfamily Pooideae. Five of the new species belong to the genus *Calamagrostis*.

Calamagrostis is an important genus in all páramos and other high-altitude vegetation types in Andean regions. In Ecuador 21 species were known until now.

Numerous older studies of the genus, with *Deyeuxia* included, were summarized by Hitchcock (1927). Since then, a couple of new species were described for Ecuador by Swallen (1948), and a section of the genus, *Stylagrostis*, was studied and one new species for Ecuador was described by Escalona (1988a, 1988b). The Peruvian species were revised by Tovar (1960, 1993) and the Bolivian species recently by Villavicencio (1995).

In the lower mountain regions of Ecuador, from ca. 1500 to ca. 2500 m, only the three broad- and soft-leaved species, *Calamagrostis rupestris* Trinius, *C. planifolia* (Kunth) Trinius, and *C. viridiflavescens* (Poiret) Steudel, occur, and they are mainly found in disturbed ground. *Calamagrostis viridiflavescens* has only been observed in weedy or other clearly anthropogenic vegetation types and may have been introduced. Only relatively few species of *Calamagrostis* occur in the regularly burned grass páramos at approximately 3300–4100(–4300) m that are considered rather recent secondary vegetation types by Lægaard (1992). *Calamagrostis recta* (Kunth) Trinius ex Steudel is common and often dominant in all of these páramos. *Calamagrostis effusa* (Kunth) Steudel is common and often codominant in the northernmost regions of Ecuador, the provinces of Carchi and Imbabura, while *C. macrophylla* (Pilger) Pilger occurs in the same way in southern Ecuador in the Loja province. Besides these *C. rigida* (Kunth) Trinius ex Steudel, *C. intermedia* (Presl) Steudel, and *C. bogotensis* (Pilger) Pilger are found more scattered in grass páramo vegetation but also seem to be tolerant to regular burning. In the same altitudinal region a number of other species occur, but these are mainly confined to moist ground and swamps where they are protected against fires. These include *C. fibrovaginata* Lægaard, *C. jamesonii* Steudel, *C. ligulata* (Kunth) Hitchcock, and *C. rigescens* (Presl) Schribner. The remaining species, including most of those described in the present paper, mainly occur in superpáramos from about 4100 m upward (Lægaard, 1992) where fires rarely or never occur. Several species have been found close to the limit for plant life in Ecuador at about 5000 m. In these superpáramos they may occur in dry biotopes, for example, *C. mollis* Pilger, or in moist sites, for example, *C. guamanensis* Escalona and *C. podophora* Pilger. However, several species are only known from a few herbarium specimens, and their ecology remains to be studied.

Calamagrostis carchiensis Lægaard, sp. nov. TYPE: Ecuador. Prov. Sucumbíos: Páramo de Mirador above Cocha Seca, lower páramo zone, burned, 77°39′W, 0°34′N, 3700–3900 m, 23 May 1985, *Lægaard 54413* (holotype, AAU; isotypes, K, MO, QCA, QCNE, US). Figure 1A.

Planta rhizomatosa vel laxe caespitosa. Panicula longa, angusta, dense florida; spiculae 3.5–4 mm; dorsum totum lemmatis scabridiusculum; arista tenuissima ca. 0.7 mm; callus sine pilis; elongatio rachillae 0.7–1.2 mm, sparsissime breve pilosa.

Single stems from rhizomes or small, loose tussocks, 50–85 cm high, leaves mainly cauline.

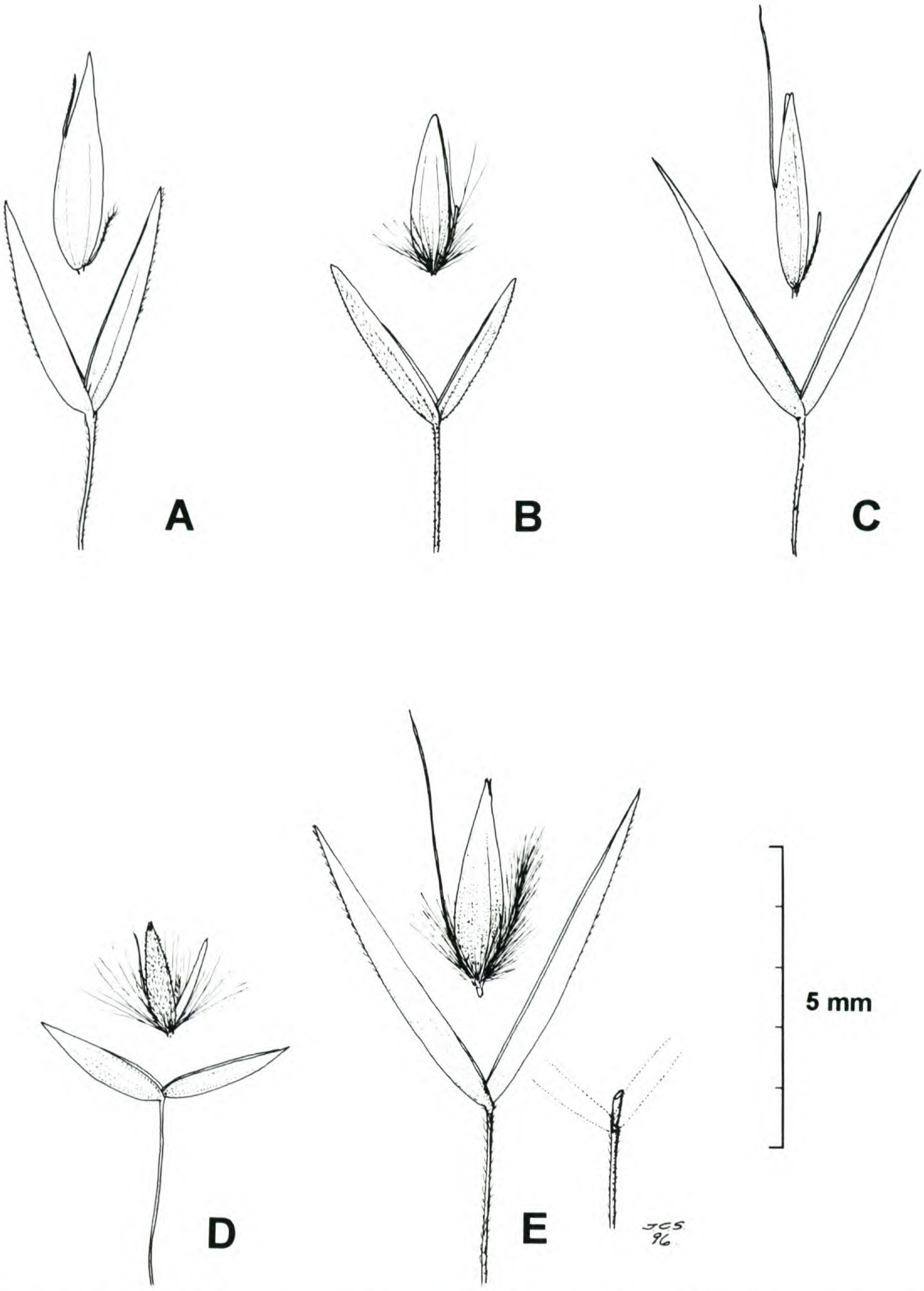


Figure 1. Spikelets of *Calamagrostis*. —A. *Calamagrostis carchiensis* (from *Lægaard 54413*, holotype, AAU). —B. *Calamagrostis ecuadoriensis* (from *Lægaard 53295*, holotype, AAU). —C. *Calamagrostis fulgida* (from *Lægaard 53765*, holotype, AAU). —D. *Calamagrostis llanganatensis* (from *Holm-Nielsen & Jaramillo 28362*, isotype, AAU). —E. *Calamagrostis teretifolia* (from *Lægaard 102798*, holotype, AAU).

Culms striate, 1.5–2 mm diam., scabrid or glabrous, internodes longer or shorter than sheaths, nodes dark. Sheaths striate furrowed, glabrous, basal sheaths disintegrating into fibers; ligules ca. 3 mm, rounded, margin frayed; leaf blades 15–30 × ca. 0.7 cm, linear, tapering to a long point, flat or involute, abaxially striate, glabrous except finely hispid at base, adaxially deeply furrowed, glabrous. Panicle long and slender, 12–19 × 0.5–0.8 cm, dense, somewhat glomerulate interrupted, branches single, widely spaced, erect and densely appressed, lower part naked; axis, branches, and pedicels scabrous to finely hispid. Spikelets 3.5–4 mm, tenuiforme to slightly flattened. Glumes subequal, 3.5–4 mm, lanceolate, first glume 1-nerved, second glume 3-nerved, lateral nerves rather weak, both glumes keeled in distal ⅔, purplish spotted, glabrous but scabrid on nerves; lemma 3.5–4 mm, lanceolate, apex irregularly erose, 5-nerved, pale, finely scabrid, awn very short and slender, 0.7–1 mm, from ¾ above base of lemma; callus hairs lacking; rachilla prolongation 0.7–1.2 mm, very sparsely and shortly haired; palea ca. 2.5 mm, linear, 2-keeled; stamen 1, anther 1.2 mm, purple; caryopsis 1.8 × 0.4 mm, rounded triangular in transection, pale brown, embryo ⅙ of total length.

In the material studied there is some variation in the surface of glumes; in some plants these are nearly glabrous but scabrid on nerves, and in others they are finely scabrid all over.

Calamagrostis carchiensis is close to *C. bogotensis* (Pilger) Pilger. They are both loosely caespitose or shortly rhizomatous and with long, narrow and dense inflorescences, spikelets are about the same size, and both have only one stamen with the anther about 1 mm long. However, they may be distinguished in several ways, among these comparison of leaf blades and spikelets. *Calamagrostis bogotensis* has leaf blades rather narrow, in dried condition densely involute, terete, diameter 1–1.5 mm, the abaxial surface glabrous or in young leaves hirsute at base, hairs very fine, 0.5–1 mm, spreading, and the adaxial surface has ca. 10 ribs and is densely scabrous. *Calamagrostis carchiensis* has rather broad leaf blades, 5–7 mm, usually flat or loosely involute in dried condition, the abaxial surface at base of leaf finely hispid, hairs ca. 0.1 mm, retrorsely appressed, and the adaxial surface has 20–30 ribs and is glabrous or sparsely hispid. The glumes of *C. bogotensis* are glabrous and more or less shining, the awn is fixed in lower third of lemma, and is rather strong and at maturity more or less bent and twisted. It is usually as long as the glumes and clearly visible between these. The glumes of *C. carchiensis* are more or less scabrid and mat, the awn is fixed above the middle of the lemma, and is short and weak and even at maturity concealed by the glumes.

Calamagrostis bogotensis is distributed from Colombia to northern Peru. *Calamagrostis carchiensis* has only been recorded from the province of Carchi and adjoining mountainous parts of Sucumbíos Province (previously a part of Napo Province). Most probably it also occurs in southern Colombia and should be sought there.

Paratypes. ECUADOR. **Carchi:** Páramo del Angel, 3200–3800 m, *Lægaard 55773C* (AAU); Km 14 along road Las Juntas (Tulcán)–El Angel, 3400 m, *Lægaard 101730* (AAU, MO, QCA, QCNE, US).

Calamagrostis ecuadoriensis Lægaard, sp. nov. TYPE: Ecuador. Prov. Tungurahua: Cordillera de Llanganatis, Páramo de Jaramillo, 78°22′W, 01°10′S, 4000–4250 m, 2–4 Nov. 1984, *Lægaard 53295* (holotype, AAU; isotypes, MO, QCA, QCNE, US). Figure 1B.

Planta caespitibus parvis, foliis basalibus brevibus involutis. Paniculae angustae. Spiculae 3.5–4 mm, purpureae, flosculi breve stipitati, glumae 3-nerviae, lemma 5-nervia, scabridiuscula, sine arista, pilis calli 1–1.5 mm, elongatio rachillae ca. 1.5 mm, pilis 1–1.5 mm.

Small tussocks, 20–30 cm high, with intravaginal innovations, leaves mostly basal. Culms ca. 1 mm diam., furrowed, hispid, usually with 2 leaves, internodes shorter than sheaths. Basal leaves with short sheaths, 2–3(–5) cm long, shallowly furrowed, glabrous, fibrous by age; ligule 0.5–1 mm, truncate; collar distinct ± swollen; leaf blades 3–7 cm long, involute, 0.3–1 mm diam., abaxially furrowed, glabrous, adaxially deeply furrowed, finely hispid; culm leaves with long sheaths, upward slightly inflated, membranous auricles higher than ligule, leaf blades 1–1.5 cm long, involute. Panicles narrow, 8–10 × ca. 1 cm, axis, branches, and pedicels densely hispid, all dark purplish; spikelets usually 1-flowered, several 2-flowered; glumes 3.5–4 mm, subequal, both 3-nerved with lateral nerves rather faint, broadly lanceolate with apex obtuse, finely erose, keeled toward apex, scabrid and mat on and between nerves, glabrous and shining along margin; floret on short stipe, ca. 0.15 mm; lemma ca. 3 mm, 5-nerved, ovate, apex obtuse, scabrid on back, awn lacking; callus hairs rather scant, 1–1.5 mm; rachilla prolongation ca. 1.5 mm, with hairs 1–1.5 mm, almost reaching apex of lemma; palea ca. 2 mm, 2-nerved with scabrid, keeled nerves, pale; stamens 3, anthers 0.8–1 mm, purple; caryopsis not seen.

With the small tussocks, the small, rather plump,

dark purple spikelets, and the lack of an awn, the species is easily confused with an *Agrostis*, but with the callus hairs and the well-developed rachilla prolongation it clearly belongs to *Calamagrostis*. The only other species with externally similar spikelets is *C. llanganatensis* Lægaard, but this is different, for example, in leaves and details of spikelet structures.

Calamagrostis ecuadoriensis has only been found in the western cordilleras of central and northern Ecuador. According to label notes and remains on the specimens it belongs to humid superpáramo vegetation with cushion plants.

Paratypes. ECUADOR. **Pichincha/Napo:** W side of mountain ridge ca. 2 km to the W from Cerro SaraUrcu, 4300 m, *Sklenar & Kosteckova 1827* (AAU). **Napo:** Cordillera de los Llanganates, shoulder of Cerro Hermoso 1.5 km W of the summit, 3950 m, *Holm-Nielsen & Jaramillo 28743* (AAU, S, US). **Chimborazo:** at pass Alao–Huamboya, 3900–4000 m, *Lægaard 55427* (AAU); El Altar, N side of the volcano, below the Canoningo peak, 4500 m, *Sklenar & Kosteckova 90-8* (PRC); 4400 m, *Sklenar & Kosteckova 1915* (AAU). **Azuay:** Road Gualaceo–Sucua, just W of pass, 3450 m, *Lægaard 53212* (AAU, MO, QCA,QCNE).

Calamagrostis fulgida Lægaard, sp. nov. TYPE: Ecuador. Prov. Zamora–Chinchipe: road Vilcabamba–Valladolid, ca. 8 km S of provincial border, 79°09′W, 04°29′S, 2500 m, 28 Feb. 1985, *Lægaard 53765* (holotype, AAU; isotype, QCA). Figure 1C.

Planta dense caespitosa, tenuis. Panicula angusta, aliquot aperta. Spiculae fulgidae, pallidae; glumae 4.5–5.5 mm, lemma scabridiuscula, arista brevi et tenui; pili calli sparsissimi brevi, elongatio rachillae ca. 1 mm, sparsissime breve pilosa; stamina 3, antherae 1.3 mm.

Densely caespitose, 40–50 cm high, slender, leaves mainly basal. Culms 0.7–1 mm diam., finely striate, glabrous to finely hispid in distal part. Sheaths longer than internodes, slightly inflated, deeply furrowed, glabrous; ligule 3–5 mm, broadly truncate, firm, scabrid-opaque; leaf blades teretely involute, diam. 1–1.5 mm, abaxially finely striate at base, upward non-striate, glabrous, adaxially deeply furrowed, scabrous, apex rigid, blunt. Panicle narrow, ca. 13 × 1 cm, rather lax, branches erect, branched and floriferous from base, axis and branches scabrous. Spikelets 4.5–5.5 mm, tenuiform to flattened, glabrous and shining, pale greenish-stramineous. Glumes 4.5–5.5 mm, lanceolate, acute, equal, or first glume longest, both 1-nerved, keeled, especially in distal half, pale green along nerve, membranous in a broad marginal zone, glabrous and shining; lemma 3.5–4 mm, lanceolate, apex obtuse, irregularly bilobed, 3-nerved, finely scabrid, awn ca. 3 mm, delicate, straight, from ⅗ above base; callus hairs extremely scant and short, ca. 0.1 mm, rachilla prolongation ca. 1 mm, with very scant and short hairs from lower half; palea ca. 3.5–4 mm, 2 very faint nerves; stamens 3, anthers 1.3 mm, purplish; caryopsis not seen.

Calamagrostis fulgida is superficially rather similar to the very variable *C. recta* (Kunth) Trinius ex Steudel. It differs, for example, in spikelet structures by the almost complete lack of hairs on callus and rachilla, and by the awn which is delicate and straight, while in *C. recta* it is coarse, twisted, and bent.

Only known from the type specimen.

Calamagrostis llanganatensis Lægaard, sp. nov. TYPE: Ecuador. Prov. Tungurahua: Cordillera de los Llanganates, saddle between Río Topo and Río Verde on W side of Cerro Hermoso, 2.4 km from summit, *Polylepis* scrub, 78°18′W, 1°13′S, 3850 m, 10 Nov. 1980, *Holm-Nielsen & Jaramillo 28362* (holotype, QCA; isotypes, AAU, MO, US). Figure 1D.

Planta panicula grandidiffusa; spiculae parvae purpureae; glumae 2.5–2.7 mm, lemma 2.3 mm, scaberula, arista brevissima tenuis, pili calli aliquot sparsi, lemma aequantes, sine elongatione rachillae, stamina 3, antherae ca. 1 mm.

Loosely caespitose or with short rhizomes, 120–150 cm high, leaves cauline. Culms ca. 3 mm diam., glabrous, internodes usually longer than sheaths, nodes dark, 3–5 mm long. Sheaths striate, glabrous; ligule 3–4 mm, irregularly rounded, firm, scabrid; leaf blades 15–20 × 0.6–1 cm, flat, abaxially striate, scabrid, adaxially furrowed, scabrous. Panicle 40–50 × 10–15 cm, very diffuse, branches and pedicels very slender, glabrous, shining, pedicels 5–8 mm, finely flexuous. Spikelets ca. 2.5 mm, shortly tenuiforme or open; glumes subequal, 2.5–2.7 mm, 1-nerved, with broadly rounded back, acute, purplish, glabrous and shining, lower glume broadly lanceolate, upper glume narrower; lemma ca. 2.3 mm, no visible nerves, with broadly rounded back, apex obtuse and finely frayed, pale, distinctly scabrid, awn short and weak, from ⅓ to ½ above the base, hardly reaching apex; callus hairs rather sparse, as long as lemma or a little longer, somewhat flexuous; rachilla prolongation lacking; palea ca. 1.5 mm, no visible nerves, pale, glabrous and shining; stamens 3, anthers ca. 1 mm, purplish; caryopsis not seen.

The description above is from the type and similar specimens but all specimens studied show a

considerable variation in size and general appearance. *Holm-Nielsen & Jaramillo 28263* and *28659* are both rather tall and have large panicles, and they are very close to the type in general growth-form. *Lægaard 55455*, *Asplund 9817*, and *9891* are smaller and have much shorter panicles, while *Øllgaard et al. 38707* and *Asplund 9894* are small tussocks about 40 cm tall and have narrower and mostly basal leaves. However, spikelet structures are very similar in all specimens and they clearly belong to the same species. *Calamagrostis llanganatensis* has been found in the eastern cordilleras of central Ecuador at about 3500–4000 m in a humid and cold zone. According to label notes it occurs in scrub as well as in open páramo swamps; the different plant sizes are probably related to that.

The only other species of *Calamagrostis* in Ecuador that has similar small and purplish spikelets, superficially similar to an *Agrostis*, is *C. ecuadoriensis*. They differ, for example, in the leaves that are short, narrow, and tightly involute in *C. ecuadoriensis* versus broad and flat in *C. llanganatensis*, and in details of spikelet structures. *Calamagrostis ecuadoriensis* has a well-developed, hairy rachilla prolongation, while this is lacking in *C. llanganatensis*.

Paratypes. ECUADOR. **Tungurahua:** Cordillera de los Llanganates, Lomo 2.5 km W of Cerro Hermoso, 3800 m, *Holm-Nielsen & Jaramillo 28659* (AAU, MO); Cordillera de Llanganates, near Las Torres, 3500–3800 m, *Asplund 9817, 9891, 9894* (S). **Napo:** Cordillera de los Llanganates, Loma between Río Topo and Río Verde Grande, 3.5 km NW of Cerro Hermoso, 4000 m, *Holm-Nielsen & Jaramillo 28263* (AAU, MO, S, US); Llanganati, N-facing slope towards the Río Golpe, just N of Chosa Aucacocha, spring-fed lake, 3600 m, *Øllgaard et al. 38707* (AAU). **Pastaza:** E of pass Alao–Huamboya, 3600–3700 m, *Lægaard 55455* (AAU, B, K, MO, PRC, QCA, QCNE, S, US, W).

Calamagrostis teretifolia Lægaard, sp. nov. TYPE: Ecuador. Prov. Chimborazo: Volc. Chimborazo, just below the lower Refúgio (4840 m), 78°50′W, 01°28′S, 11 May 1992, *Lægaard 102798* (holotype, AAU; isotype, QCA). Figure 1E.

Planta caespitibus parvis densis; folia basalia brevia, cylindrica, involuta, ligula longa et acuta. Panicula brevis angusta. Flosculi stipitati, lemma ad apicem denticulatum, callus et elongatio rachillae dense et recte pilosi.

Small, dense tussocks, 15–30 cm, leaves mainly basal, with 1–2 short culm leaves. Culm 0.7–1 mm diam., striate, glabrous. Sheaths of basal leaves 2–3 cm, striate, glabrous, and shining, remaining as a cover when withering; ligules membranous, long and acute, 6–10 mm; leaf blades 3–5 cm, rigid, strongly involute and terete, 0.5–0.8 mm diam., finely striate, glabrous, apex blunt, hard; culm leaves with sheaths longer than internodes, slightly inflated, striate-furrowed, glabrous, leaf blades 1–1.5 cm. Panicles 5–6 × ca. 1 cm, dense, slightly interrupted, branches short, erect, floriferous from base, axis glabrous below, upward scattered and finely hispid as the branches. Spikelets ca. 6 mm, tenuiform. Glumes ca. 6 mm, subequal, lanceolate, apically irregularly erose, 1-nerved, glabrous and shining except distal half of nerve which is scabrous, greenish purple in central part, pale brown and membranous along margins; floret on a stipe, ca. 0.5 mm, with oblique disarticulation, with or without a small tuft of hairs at base; lemma ca. 3.5 mm, broadly lanceolate, 3-nerved, apex irregularly split into a few fine teeth, glabrous and shining, spotted purplish, with an awn, ca. 4 mm, nearly from base of lemma; callus hairs straight and dense, 1–2 mm; rachilla prolongation ca. 2 mm, with a dense tuft of hairs, 1–2 mm long; palea ca. 2.3 mm, linear, 2-keeled; stamens 3, anthers ca. 1.2 mm; caryopsis not seen.

Calamagrostis teretifolia is closely related to the other stipitate species, *C. ligulata* (Kunth) Hitchcock and *C. podophora* (Pilger) Pilger. *Calamagrostis podophora* was considered by Escalona (1988a, 1988b) and Tovar (1960, 1993) to be a synonym of *C. ligulata*, but it is here accepted as a distinct species. *Calamagrostis ligulata* is distinct from the other two species by usually being much taller, 50–80 cm, and by having an open panicle with long, pendent branches that are naked in the lower half and with spikelets more or less glomerulate in the distal half. *Calamagrostis podophora* and *C. teretifolia* are both rather short, 20–40 cm, and have rather dense panicles with more or less erect branches that are floriferous nearly from the base. *Calamagrostis podophora* has callus hairs as long as or longer than the lemma, a rachilla extension ca. 1 mm, with hairs short and scant or, if more copious, only in the distal half, awn 6–7 mm, clearly longer than glumes. *Calamagrostis teretifolia* has callus hairs about half as long as the lemma, rachilla extension ca. 1 mm, with copious hairs almost reaching the apex of the lemma, and an awn ca. 4 mm, about the length of the lemma.

The three known specimens of *Calamagrostis teretifolia* are from very high altitude, 4300–4800 m, and have been found both in western and eastern cordilleras of central Ecuador.

Paratypes. ECUADOR. **Chimborazo/Morona-Santiago:** Cerro Yanaurcu, on W side of the N ridge of the mountain, 4300 m, *Sklenar & Kosteckova 1852* (PRC).

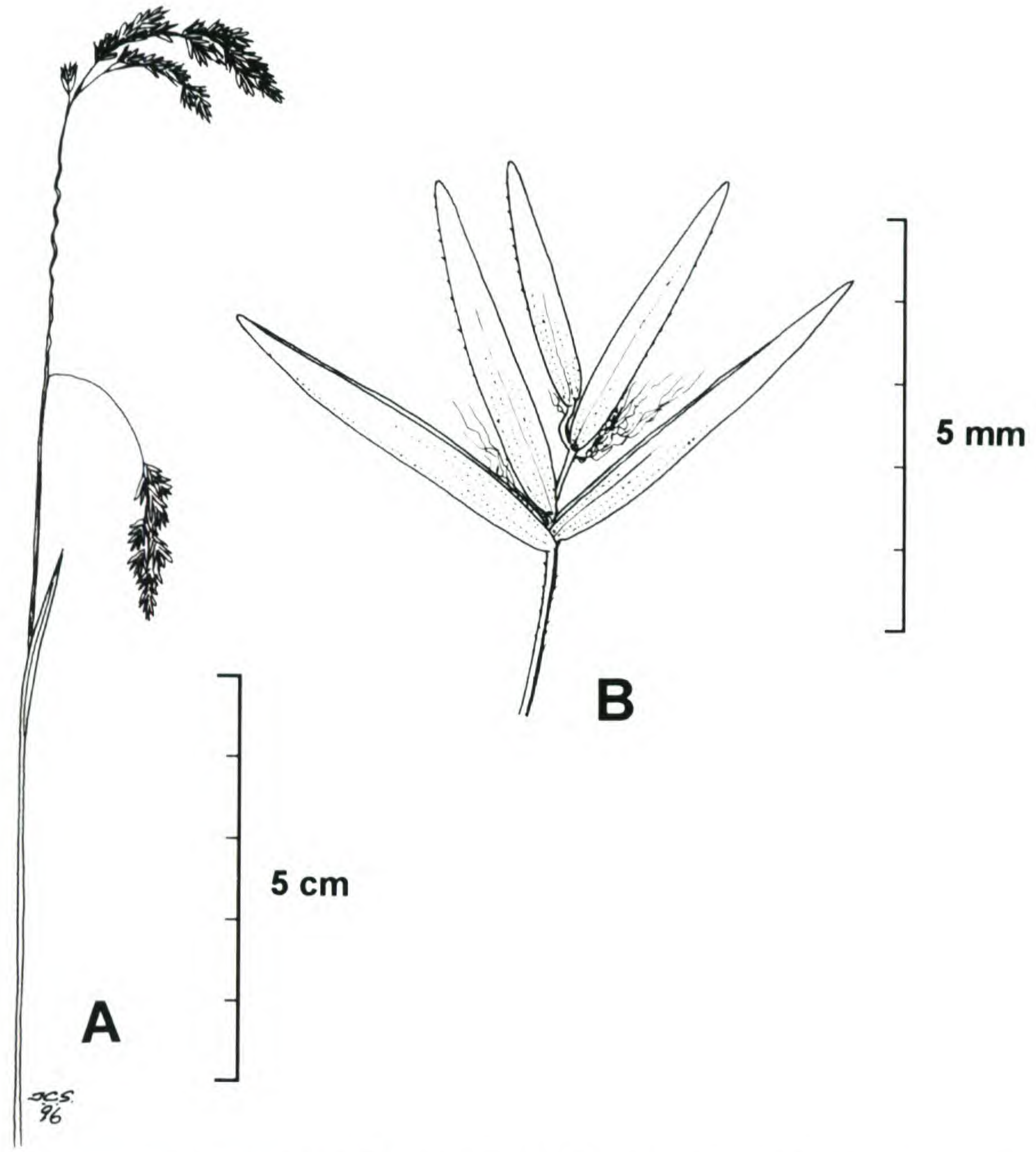


Figure 2. *Poa paramoensis* Lægaard. —A. Panicle. —B. Spikelet. (From *Lægaard 52843*, isotype, AAU.)

Azuay: Parque Nac. de Las Cajas, along trail from highest point on Molleturo-road to Paragüillas, 4300–4400 m. *Lægaard* 102673 (AAU).

Poa paramoensis Lægaard, sp. nov. TYPE: Ecuador. Prov. Azuay: Páramo de las Cajas W of Cuenca, 79°14′W, 02°47′S, 4000–4150 m, 2 Sep. 1984, *Lægaard 52843* (holotype, QCA; isotypes, AAU, MO, QCNE, S, US). Figure 2A,B.

Panicula ramis solitariis laxe pendulis; spiculae angustae, ca. 5 mm, 2-florae, glumae spiculam aequantes, glabrae; lemmata carinata scabridiuscula, ad basin fasciculo pilorum arachnoideorum longorum.

Small, rather loose tussocks, 15–40 cm, innovations intravaginal, leaves mainly basal, usually with only 2 short culm leaves. Culms slender, ca. 0.5 mm diam. below panicle, finely furrowed, glabrous. Basal leaves with shortly persistent sheaths, often with leaf blades disarticulating at collar, culm leaves with sheaths longer than internodes, furrowed, glabrous; collar a broadly triangular zone in basal leaves, not distinct in culm leaves; ligula 3–4 mm, membranous, acute, delicate and often frayed, abaxially scabrid; basal leaf blades 5–6 cm, culm leaves 1–2 cm, folded, ca. 1 mm broad as folded, abaxially shallowly furrowed, glabrous, adaxially striate, finely scabrid, apex naviculate, acute, somewhat pungent. Panicle 6–8 cm long, axis usually flexuous, rounded angular, glabrous, with 2–3 widely spaced, pendent branches, one from each node, very slender, ca. 0.2 mm, terete, glabrous, unbranched in basal part, pedicels 0.5–2 mm, clavate, usually finely scabrid; spikelets ± glomerulate in distal ⅓–½. Spikelets 5–5.5 mm, lanceolate, glabrous, shining, stramineous or purplish, with 2 or 3 florets, the first hermaphrodite, the following usually female, disarticulating above

glumes and between florets, rachilla joints ca. 1 mm, distal rachilla prolongation with small rudiment; glumes as long as or slightly shorter than spikelets, subequal, first glume usually shortest, both with a distinct midnerve, second glume with two faint lateral nerves in lower half, margins scarious in a narrow to rather broad zone; lemma ca. 4.5 mm, 3-nerved, keeled, glabrous but nerves finely scabrid, margins scarious, with a small tuft of long cobweb hairs from base; palea ca. 3.5 mm, with scabrid keels; stamens 3, anthers ca. 1.8 mm, pale; anther rudiments in distal florets very small, <0.1 mm; caryopsis ca. 2 mm, lanceolate, rounded triangular in transection, embryo small, ca. ⅕ of total length, hilum small, oval.

Poa paramoensis has been collected in western and eastern cordilleras of central and northern Ecuador in very moist sites, often in deep mossy swamps from (3300–)3700 to 4300(–4500) m. It is often found with *Calamagrostis ligularis* with which it has a superficial similarity in growth-form and in the pendent panicle branches.

Poa paramoensis is close to *P. cucullata* Hackel from the same zone of high páramos. This is rather variable and in need of a detailed study; the material studied now may consist of several, closely related species. *Poa paramoensis* has a combination of intravaginal innovations and narrow leaves, the panicle is open and lax with long, fine and glabrous, pendent branches, the spikelets are long and narrow, the glumes are as long as or nearly as long as the spikelets, the keel is glabrous, and the glumes and lemmas are shining and with rather broad and scarious marginal zones. Specimens usually attributed to *P. cucullata* have intra- or extravaginal innovations, leaves are broader, more robust, the panicle is usually more condensed with shorter, more robust, often scabrid or hispid branches, the spikelets are usually broader, more plump, mat, the glumes are usually distinctly shorter than the spikelets and usually with a scabrid keel, and the glumes and lemmas are more robust, usually dark purplish, without or with narrow scarious zones.

Paratypes. ECUADOR. **Carchi:** Km 11 along road Las Juntas (Tulcán)–El Angel, 3330 m, *Lægaard 101715* (AAU, MO, QCA). **Pichincha:** at Laguna Negra de Mojanda, 3700 m, *Lægaard 101489* (AAU); Pifo–Papallacta km 18 along new road, 3700 m, *Lægaard 102323* (AAU, QCA); Road Pifo–Papallacta, ca. 3 km W of Paso de la Virgen, 3700–3900 m, *Lægaard 54880, 54890* (AAU); Pifo–Pintag, in valley 2½ hours' horseride above Inga Monserat, 3625–3725 m, *Lægaard 102250* (AAU). **Pichincha/Napo:** along road from Paso de La Virgen to the Antenas, 4050–4100 m, *Lægaard 101375* (AAU, B, BM, COL, F, GB, K, L, MO, NY, P, PRC, QCA, QCNE, S, US), *103104* (AAU); Volc. Antisana, between Camparmento IMAP and Laguna Micacocha, 3850–3950 m, *Lægaard 101602* (AAU, MO, QCA, US), *101603* (AAU). **Pichincha/Cotopaxi:** NE slope of Iliniza Sur, 4500 m, *Sklenar & Kosteckova 1865* (AAU). **Cotopaxi:** Zumbahua–Pujilí km 39, 3750–3800 m, *Lægaard 102083* (AAU), *102092* (AAU, QCA); Angamarca-road, km 5 from junction to Latacunga–La Maná, 4100–4200 m, *Lægaard 102135* (AAU, K, MO, QCA). **Chimborazo:** El Altar, N side of the volcano, [–] ridge below the Canoningo peak, 4200 m, *Sklenar & Kosteckova 95-10* (PRC); Páramo above Azul along road to Osogochi, 4000 m, *Lægaard 71010* (AAU). **Azuay:** Páramo de Soldados–Angas, at highest point of the road, 3950–4050 m, *Lægaard 70104* (AAU); Parque Nac. de Las Cajas, along trail from highest point on Molleturo-road to Paragüillas, 4200–4300 m, *Lægaard 102663* (AAU). **Chimborazo/Morona-Santiago:** Cerro Yanaurcu, N ridge of mountain, 4200–4300 m, *Sklenar & Kosteckova 1540* (AAU, PRC).

Calamagrostis fibrovaginata Lægaard, nom. nov. Replaced name: *Calamagrostis coarctata* (Kunth) Steudel, Nom. Bot. ed. 2 Vol 1: 250. 1840, not Torrey ex Eaton, Man. bot. ed. 5: 144. 1829. TYPE: Ecuador. Quito, *Bonpland s.n.* (holotype, P not seen; isotype, COL).

Calamagrostis coarctata (Kunth) Steudel is a common and well-defined species that is distributed in the higher Andes from Colombia to Peru. It was described as *Deyeuxia coarctata* Kunth (1816) and later transferred to *Calamagrostis* by Steudel (1840). However, a North American species had already been published as *Calamagrostis coarctata* Torrey ex Eaton (1829), presumably based on *Arundo coarctata* Torrey (1823), according to Hitchcock's Man. U.S. Grasses 2 ed.: 840 (1950). Thus, a new name is needed for the species in the genus *Calamagrostis*.

Calamagrostis hirta (Sodiro ex Mille) Lægaard, comb. nov. Basionym: *Deyeuxia hirta* Sodiro ex Mille, Sertula Florae Ecuadorensis Ser. 4. Gramineas Ecuatorianas, segunda parte, Revista del Colegio Vicente Rocafuerte nos. 11(40–41): 75, fig. sin pag. 1930. TYPE: Ecuador. "Crece en los prados de la Sierra, cerca de Quito, Chillogallo y Paluguillo (Mille)," (holotype, QPLS?).

There has been some doubt about the identity of *Deyeuxia hirta* Sodiro ex Mille. A type may exist in QPLS in Quito but has not been available for study. It may be identified as the holotype by comparison with a photo published with the protologue. However, several specimens studied in S, US, and W fit very well with Sodiro's detailed diagnosis and are clearly different from all other species known in Ecuador. *Calamagrostis hirta* has some similarity with *C. heterophylla* (Weddell) Pilger. Both have a

dense and somewhat lobed panicle, but the spikelets in *C. heterophylla* are small, ca. 3.5 mm, and minutely scabrid, whereas they are 6–7 mm and glabrous in *C. hirta*.

Specimens studied. ECUADOR. **Imbabura:** Paramo de Angochagua, 2900–3600 m, *Acosta Solís 18846* (US). **Imbabura/Pichincha:** Otavalo to Malchinguí, ca. 3000 m, *Hitchcock 20827*, annotated: "Type of *Calamagrostis spicata* Hitchc. sp. nov." [never published] and with an included manuscript with a description of the plant (US). **Pichincha:** Quito, *Jameson s.n.* (W); Quito, *Sodiro s.n.*, annotated: "Dey. heterophylla Weddell?" (W). **Chimborazo:** S slope of Mount Chimborazo, shore of a rivulet, alt. ca. 3900 m, *Asplund 8377* (S).

Festuca vaginalis (Bentham) Lægaard, comb. nov.
Basionym: *Poa vaginalis* Bentham, Pl. hartw. 261. 1846. TYPE: Ecuador. "Near the farmhouse of Antisana," *Hartweg* (holotype, K).

A character that distinguishes *Festuca* and *Poa* is the hilum, which is linear in *Festuca* and round to oval in *Poa* (Clayton & Renvoize, 1986). It is clearly linear in *Festuca vaginalis*.

The genus *Festuca* from the northern Andes was revised by Alexeev (1986). Following this revision *F. vaginalis* is close to other *Festuca* species in the region such as, for example, *F. glumosa* Hackel ex Alexeev. *Festuca vaginata* has folded or loosely involute leaves, glabrous beneath and hispid and with 9–11 ribs above. Spikelets are 8–10 mm long, more or less linear, with whitish, scarious glumes and lemmas, glumes are almost as long as the spikelet, glabrous or scabrid in distal part; lemmas are usually scabrid on the back, acute, with or without a short awn up to ca. 1 mm. *Festuca glumosa* has tightly involute leaves, usually distinctly rough beneath and with 5–7 ribs above. Spikelets are 8–10 mm long, lanceolate, with herbaceous, usually purple glumes and lemmas, glumes are about ½–⅔ as long as the spikelet, awns excluded, lemmas are acute, usually with an awn, 1–3 mm. A more distant species is the very variable *F. andicola* Kunth with narrow, completely glabrous leaves and short awns, less than ½ the length of the spikelet. These three species all have short anthers, ca. 0.5(–0.8) mm, that are included in the florets, presumably resulting in permanent self-fertilization. *Festuca densipaniculata* Alexeev of the same group has scabrid leaves with 11–15 ribs, rather short glumes and long anthers, 2.3–2.7 mm (according to the protologue, not seen).

Even after the revision by Alexeev (1986), these high Andean species are in need of more study because several specimens remain unidentified and may represent one or more undescribed species.

Nassella ibarrensis (Kunth) Lægaard, comb. nov.
Basionym: *Stipa ibarrensis* Kunth, in Nov. gen. sp. 1: 125. 1816. TYPE: Ecuador. "Crecit ad muros urbis Quitensis, Villa de Ibarra, in subfrigidis, alt 1184 hexap," *Bonpland s.n.* (holotype, P not seen).

The species clearly belongs to the genus *Nassella* according to the characters proposed by Barkworth (1990) as diagnostic, for example, the overlapping and densely clasping lemma margins.

Acknowledgments. The journeys during which the author's own collections were made were supported by the Danish Development Agency, the Julie von Müllens Fond, and Aarhus University. Thanks for hospitality and collaboration to the directors and staff of herbarium QCA at Pontificia Universidad Católica del Ecuador in Quito. Thanks to Benjamin Øllgaard, who contributed the Latin translations, and to Jens Christian Schou for the drawings.

Literature Cited

Alexeev, E. B. 1986. *Festuca* L. (Poaceae) in Venezuela, Colombia et Ecuador. Novosti Sistematiki Vyschnij Rastenii 23: 5–23.

Barkworth, M. E. 1990. *Nassella* (Gramineae, Stipeae): A revised interpretation and nomenclatural changes. Taxon 39: 597–614.

Clayton, W. D. & S. A. Renvoize. 1986. Genera Graminum. Kew Bull. Add. Ser. 13: 1–389.

Eaton, A. 1829. A Manual of Botany, 5. ed. Websters and Skinners, Albany.

Escalona, F. D. 1988a. Systematics of *Calamagrostis* section *Deyeuxia*, subsection *Stylagrostis* (Poaceae: Pooideae). Unpublished thesis, Dept. of Botany, Iowa State University.

———. 1988b. *Stylagrostis*, a new section of the genus *Calamagrostis* (Poaceae: Pooideae) and three new species from Colombia, Ecuador, and Venezuela. Phytologia 65: 337–347.

Hitchcock, A. S. 1927. The grasses of Ecuador, Peru, and Bolivia. Contr. U.S. Natl. Herb. 24: 291–556.

Kunth, C. S. 1816. *In*: Humboldt, Bonpland & Kunth, Nova Genera et Species Plantarum, Vol 1.

Lægaard, S. 1992. Influence of fire in the grass páramo vegetation of Ecuador. Pp. 151–170 *in* H. Balslev & J. L. Luteyn (editors), Páramo: An Andean Ecosystem Under Human Influence. Academic Press, London & San Diego.

Steudel, E. G. 1840. Nomenclator Botanicus, 2. ed. Vol. 1.

Swallen, J. R. 1948. New grasses from Honduras, Colombia, Venezuela, Ecuador, Bolivia, and Brazil. Contr. U.S. Natl. Herb. 29: 251–275.

Torrey, J. 1823. A Flora of the Northern and Middle Sections of the United States.

Tovar, O. 1960. Revisión de las especies Peruanas del género *Calamagrostis*. Mem. Mus. Hist. Nat. "Javier Prado" 11: 1–88.

———. 1993. Las Gramíneas (Poaceae) del Perú. Ruizia, Tomo 13.

Villavicencio, X. 1995. Revision der Gattung *Deyeuxia* in Bolivien. Dissertation, Fachbereich Biologie, Freien Universität Berlin.

New Names and New Combinations in Campanulaceae

Thomas G. Lammers
Department of Botany, Field Museum of Natural History, Chicago, Illinois 60605-2496, U.S.A.
Email address: lammers@fmppr.fmnh.org

ABSTRACT. New names and new combinations are proposed for 15 species of Campanulaceae s.l. that have no legitimate name at that rank in the genus to which they should be assigned. These nomenclatural innovations include changes of genus and rank among the endemic Hawaiian Lobelioideae, the final installment in the incorporation of *Pratia* into *Lobelia*, and replacement of two illegitimate names in Campanuloideae.

In the course of compiling a checklist of the species of Campanulaceae s.l. currently recognized in the world's taxonomic literature (floras, checklists, monographs, revisions), a few species were found to have no legitimate name in the genus to which they should be assigned. New names and combinations have been effected already (Lammers, 1995) for those involving the illegitimate generic name *Lightfootia* L'Héritier de Brutelle. Here, new names and new combinations are made for the remainder.

HAWAIIAN LOBELIOIDEAE

The most recent treatment of the Hawaiian Lobelioideae is the account contributed (Lammers, 1990) to the *Manual of the Flowering Plants of Hawai'i*. Since its publication, this synopsis has been expanded into a series of generic monographs. In several cases, examination of a larger body of specimens and consideration of a more comprehensive suite of characters has convinced me that taxa that I treated as conspecific did indeed merit recognition. Because the monographs of *Cyanea* Gaudichaud-Beaupré and *Delissea* Gaudichaud-Beaupré will not be completed before the checklist goes to press, the following new combinations in those genera are published here. This will also make them available for use by other workers in the areas of biological conservation and biogeography.

In the *Manual*, *Cyanea grimesiana* Gaudichaud-Beaupré subsp. *grimesiana* was circumscribed very broadly, encompassing not only populations on O'ahu (the type locality), but also those on Moloka'i, Maui, and Lāna'i. However, some of these latter populations (recognized as varieties by earlier botanists) are distinguishable morphologically, both from each other and from the O'ahu populations of *C. grimesiana* subsp. *grimesiana*. Furthermore, the degree of morphological differentiation is commensurate with that usually accorded specific rank elsewhere in the genus. Consequently, these plants and those previously recognized as *C. grimesiana* subsp. *cylindrocalyx* are here elevated to specific rank.

Cyanea cylindrocalyx (Rock) Lammers, comb. et stat. nov. Basionym: *Cyanea grimesiana* var. *cylindrocalyx* Rock, Bull. Torrey Bot. Club 44: 235. 1917. *Delissea grimesiana* var. *cylindrocalyx* (Rock) H. St. John, Phytologia 63: 83. 1987. *Cyanea grimesiana* subsp. *cylindrocalyx* (Rock) Lammers, Syst. Bot. 13: 502. 1987. TYPE: Hawaiian Islands. Hawai'i: Waipi'o Valley [Waimā branch], 16 July 1909, *Rock 4629* (holotype, BISH; isotypes, BISH [2]).

Cyanea mauiensis (Rock) Lammers, comb. et stat. nov. Basionym: *Cyanea grimesiana* var. *mauiensis* Rock, Monogr. Stud. Haw. Lobelioid. 251. 1919. *Delissea grimesiana* var. *mauiensis* (Rock) H. St. John, Phytologia 63: 84. 1987. TYPE: Hawaiian Islands. West Maui: gulch of "Olualu" [Olowalu], Aug. 1870, *Hillebrand s.n.* (lectotype, designated by Lammers [1994: 558], US; isotypes, GH, K).

Cyanea grimesiana var. *lydgatei* Rock, Monogr. Stud. Haw. Lobelioid. 251. 1919. Syn. nov. *Delissea grimesiana* var. *lydgatei* (Rock) H. St. John, Phytologia 63: 83. 1981. TYPE: Hawaiian Islands. East Maui: Makawao, Hāmākua, *Lydgate 62* (Rock [1919: pl. 140], designated by Lammers [1994: 558]).

Cyanea munroi (Hosaka) Lammers, comb. et stat. nov. Basionym: *Cyanea grimesiana* var. *munroi* Hosaka, Occas. Pap. Bernice Pauahi Bishop Mus. 14: 30. 1938. *Delissea grimesiana* var. *munroi* (Hosaka) H. St. John, Phytologia 63: 84. 1987. TYPE: Hawaiian Islands. Lāna'i: Kaiholena, 3 Nov. 1913, *Munro 166* (holotype, BISH; isotypes, BISH [2], US).

These species may be distinguished using the following key. Note that the populations of *C. grimesiana* on O'ahu are still divided into subspecies *grimesiana* and subspecies *obatae* (H. St. John) Lammers.

1a. Hypanthium campanulate, the base rounded or truncate; corolla 7.5–12 times longer than the hypanthium, the dorsal lobes 35–40 mm long, as long as the tube to half again as long; dorsal anthers 15–16 mm long and the ventral ones 12–14 mm long (Maui) . . . . . *C. mauiensis*

1b. Hypanthium obconic, the base attenuate; corolla 4–7.5 times longer than the hypanthium, the dorsal lobes 15–32 mm long, ⅓ as long as the tube to about as long; dorsal anthers 9.5–14 mm long and the ventral ones 7.5–10 mm long.

2a. Calyx lobes spreading at base before curving upward; corolla tube broadest at or near middle, tapering toward both apex and base, strongly arcuate; base of anther tube pubescent (Moloka'i, Lāna'i) . . . . . *C. munroi*

2b. Calyx lobes erect from base or nearly so; corolla tube broadest at base, tapering toward the apex, curved or somewhat arcuate; base of anther tube glabrous.

3a. Upper portion of lamina pinnately parted or cleft, 2–4.5 cm wide between the segments; calyx lobes connate at base for 7–25 mm; dorsal corolla lobes ¾ as long as the tube to almost as long; only the two ventral anthers pubescent at apex (Waipi'o Valley on Hawai'i) . . . . . *C. cylindrocalyx*

3b. Upper portion of lamina pinnately divided, 0.2–1.5 cm wide between the segments; calyx lobes distinct but overlapping; dorsal corolla lobes ⅓–⅔ as long as the tube; all five anthers pubescent at apex . . . . . *C. grimesiana*

4a. Segments of the lamina narrowly elliptic, narrowly oblong, or narrowly triangular; calyx lobes 3–13 mm long, 1–2 mm wide, linear or narrowly triangular, separated at base by narrow sinuses; anther tube 2.5–3.2 mm diam. (S Wai'anae Mts. of O'ahu) . . *C. grimesiana* subsp. *obatae*

4b. Segments of the lamina lanceolate or rarely narrowly elliptic; calyx lobes 15–30 mm long, 4–10 mm wide, ovate or lanceolate, overlapping at base; anther tube 3.5–4.5 mm diam. (Ko'olau and N Wai'anae Mts. of O'ahu, Moloka'i) . . . . . *C. grimesiana* subsp. *grimesiana*

Although *Rollandia* Gaudichaud-Beaupré was recognized in the *Manual*, subsequent data from chloroplast DNA restriction site analysis indicated that its species were embedded well within the phylogeny of *Cyanea*, making that genus paraphyletic. To remedy this situation, the taxa of *Rollandia* recognized in the *Manual* were transferred to *Cyanea* (Lammers et al., 1993). In the course of monographic studies, however, it became apparent that two additional species formerly assigned to *Rollandia* could be distinguished and thus required names in *Cyanea*.

The first, *C. calycina*, was treated in the *Manual* as a subspecies of *Rollandia lanceolata* Gaudichaud-Beaupré, and maintained at that rank and position upon transfer to *Cyanea*. However, the morphological differences separating the two groups of populations are more pronounced than is usual for conspecific subspecies in the group. Particular weight is given to the branched or clustered hairs on the abaxial leaf surface. Such hairs are unusual in Lobelioideae. They are known from no other Hawaiian species, occurring only in some species of the neotropical genera *Centropogon* C. Presl and *Siphocampylus* Pohl (Lammers, in press). Furthermore, the ranges of the two supposed subspecies overlap to a greater degree than previously realized, while morphologically intermediate specimens are quite rare.

Cyanea calycina (Chamisso) Lammers, comb. nov. Basionym: *Lobelia calycina* Chamisso, Linnaea 8: 222. 1833. *Rollandia calycina* (Chamisso) G. Don, Gen. Hist. 3: 699. 1834. *Delissea calycina* (Chamisso) C. Presl, Prodr. Monogr. Lobel. 47. 1836. *Rollandia lanceolata* subsp. *calycina* (Chamisso) Lammers, Syst. Bot. 13: 507. 1988. *Cyanea lanceolata* subsp. *calycina* (Chamisso) Lammers, Givnish & Sytsma, Novon 3: 439. 1993. TYPE: Hawaiian Islands. "O Wahu" [O'ahu]: *Chamisso s.n.* (holotype, LE).

The two species may be distinguished with the following key:

1a. Abaxial surface of lamina pubescent, at least some of the trichomes branched or clustered; hypanthium ⅕–⅛ as long as the corolla; calyx lobes rounded or truncate at apex (Wai'anae and Ko'olau Mts. of O'ahu) . . . . . *C. calycina*

1b. Abaxial surface of lamina glabrous or pubescent, but all trichomes simple; hypanthium ⅛–1/12 as long as the corolla; calyx lobes acute or obtuse at apex (S Ko'olau Mts. of O'ahu) . . *C. lanceolata*

The second transfer from *Rollandia* is *R. sessilifolia* O. Degener, which was treated in the *Manual* as a synonym of *R. longiflora* Wawra. As with *Cyanea grimesiana*, more detailed study showed that two morphologically well-defined groups of populations had been included under a single name.

Cyanea sessilifolia (O. Degener) Lammers, comb. nov. Basionym: *Rollandia sessilifolia* O. Degener, Fl. Hawaiiensis, fam. 339. 1932. TYPE: Hawaiian Islands. O'ahu: along Pūpūkea–Kahuku trail, in forest, 17 May 1931, *Degener, Hirai & Park 4106* (holotype, NY; isotypes, BISH, CAS, GH, US).

The two species may be distinguished with the following key:

1a. Leaves sessile; hypanthium obovoid; anther tube 2.7–3.4 times longer than wide, pubescent at base on the connectives (N Ko'olau Mts. of O'ahu) . . . . . *C. sessilifolia*

1b. Leaves with petioles 0.5–6 cm long; hypanthium obconic or cylindrical; anther tube 3.4–4.6 times longer than wide, the surfaces glabrous (Wai'anae and C Ko'olau Mts. of O'ahu) . . . . . *C. longiflora*

Many species described under *Delissea* by St. John (1987, 1988a, 1988b) are referable to previously described species of *Cyanea* (Lammers, 1988, 1990, 1992). A few, however, did represent species previously undescribed but referable to *Cyanea.* Two were transferred previously (Lammers, 1992), and two more are transferred here. Because their protologues contained no descriptions, only the briefest of Latin diagnoses, an expanded description is provided here for each.

Cyanea habenata (H. St. John) Lammers, comb. nov. Basionym: *Delissea habenata* H. St. John, Phytologia 63: 342. 1987. TYPE: Hawaiian Islands. Kaua'i: Limahuli Valley, in stream bed, 20° slope, dark porous wet soil, in partial shade, 2000 ft., 27 Sep. 1978, *Perlman & Wichman 224* (holotype, BISH; isotype, BISH).

Shrub, 2.4 m tall. Stems branched, glabrous. Lamina 11–20 cm long, 1.4–2.3 cm wide, narrowly elliptic or narrowly oblong; adaxial surface dark green, glabrous; abaxial surface light green, glabrous; margin callose-serrulate, often revolute; apex acuminate; base cuneate; petiole 2.5–6.8 cm long, glabrous. Inflorescences 5–10-flowered; peduncle 25–28 mm long, glabrous; rachis 4–7 mm long, glabrous; bracts deciduous; pedicels 6–8 mm long. Hypanthium 3–4 mm long, 2–3 mm diam., broadly obovoid, glabrous. Calyx lobes 0.5 mm long, deltate or shallowly deltate, the apex acute. Corolla 22–28 mm long, white faintly tinged with purple, glabrous; tube 13 mm long, 2 mm diam. at middle, gently curved, dorsally cleft for about half its length; dorsal lobes 15 mm long, 1.7 mm wide, linear, the apex acuminate; ventral lobes 11 mm long, 2 mm wide, linear, basally connate for 6 mm, the apex acuminate. Staminal column exserted; filament tube 23 mm long, glabrous; anther tube 2 mm diam., the surfaces glabrous; dorsal anthers 6 mm long; ventral anthers 4.8 mm long, with tufts of hairs at apex. Berries and seeds unknown. Known only from the type locality on northern Kaua'i.

This species is similar to *Cyanea spathulata* (Hillebrand) A. Heller of western Kaua'i and *C. kahiliensis* (H. St. John) Lammers of southern and eastern Kaua'i (see below), differing primarily in having shorter pedicels, relatively broader hypanthium, and a more deeply cleft corolla. It resembles the former in its serrulate often revolute leaves and slightly smaller flowers; and the latter in its glabrous acuminate leaves.

Cyanea kahiliensis (H. St. John) Lammers, comb. nov. Basionym: *Delissea kahiliensis* H. St. John, Phytologia 63: 343. 1987. TYPE: Hawaiian Islands. Kaua'i: Wahiawa Bog, Kāhili Ridge along road, 26 Aug. 1982, *Corn s.n.* (holotype, BISH).

Delissea inermis H. St. John, Phytologia 63: 343. 1987. Syn. nov. Not H. St. John, Phytologia 64: 172. 1988. TYPE: Hawaiian Islands. Kaua'i: Līhu'e-Kona Forest, Wahiawa Mts., on Wahiawa Stream, 10 ft. off on left and 10 ft. off on right near *Hesperomannia* on down stream side, wet rain forest, 680 m, 12 Sep. 1979, *Perlman 486* (holotype, BISH; isotypes, BISH [2]).

Delissea inermis H. St. John, Phytologia 64: 172. 1988. Syn. nov. Not H. St. John, Phytologia 63: 343. 1987. TYPE: Hawaiian Islands. Kaua'i: Wahiawa Valley, common, 742 m, 18 Sep. 1979, *Perlman 486A* (holotype, BISH; isotypes, BISH [4]).

Cyanea spathulata subsp. *longipetiolata* Lammers, Syst. Bot. 13: 504. 1988. Syn. nov. TYPE: Hawaiian Islands. Kaua'i: Wahiawa Mts., along road to Microwave Relay Towers near first radio house, 2320 ft., 7 Sep. 1984, *Flynn 940* (holotype, OS; isotype, BISH).

Shrubs, 1–4.6 m tall. Stems branched, glabrous. Lamina 8–22 cm long, 1–4 cm wide, narrowly elliptic or narrowly oblong; adaxial surface green, glabrous; abaxial surface pale green, glabrous; margin callose-crenulate; apex acute or acuminate, rarely obtuse; base cuneate; petiole 5–16 cm long, glabrous. Inflorescences 8–10-flowered; peduncle 10–80 mm long, glabrous; rachis 4–14 mm long, glabrous; bracts 0.6–0.8 mm long, deltate, deciduous; pedicels 8–18 mm long. Hypanthium 4–5 mm long, 3–4 mm diam., obovoid, glabrous. Calyx lobes 0.4–0.6 mm long, deltate or shallowly deltate, the apex acute. Corolla 19–25 mm long, white, sometimes tinged greenish or purplish, glabrous; tube 14–16 mm long, 1.5–2.5 mm diam. at middle, suberect or slightly curved, dorsally cleft for ⅕–½ its length; dorsal lobes 5–10 mm long, 0.8–1.3 mm wide, linear or linear triangular, the apex acuminate; ventral lobes 5–8 mm long, 1–1.5 mm wide, linear triangular, connate at base for 2–4 mm, the apex acuminate. Staminal column slightly exserted; filament tube 16–20 mm long, glabrous; anther tube 1.5–1.9 mm diam., the surfaces glabrous; dorsal anthers 5.2–6 mm long; ventral anthers 4.3–4.8 mm long, with tufts of hairs at apex. Berries and seeds unknown. Endemic to Kaua'i, in the Wahiawa

Mountains and at the headwaters of the Wailua River; diverse mesic forest and wet forest, 490–800 m.

Additional specimens examined. HAWAII. **Kaua'i:** Mt. Kāhili, *Carlquist 1762* (BISH); road to Kāhili transmitter station, *Fay 149* (A, BISH, F, NY, PTBG, WIS); Mt. Kāhili, *Flynn 273* (PTBG), *Flynn 671* (PTBG), *Flynn 935* (F, OS), *Flynn et al. 2379* (F, MU, PTBG); tributary of Wahiawa Str., *Flynn et al. 3463* (PTBG); Wahiawa Mts., *Forbes 197.K* (BISH, NY); Wahiawa Mts., Aug. 1909, *Forbes s.n.* (BISH); Kāhili, *Gustafson et al. 3056* (LAM); Mt. Kāhili, *Herbst 2086* (BISH, PTBG); headwaters of N fork Wailua R., *Lorence et al. 5367* (F, PTBG); Wahiawa Mts., *Lydgate s.n.* (BISH).

In the *Manual*, this taxon was treated as a subspecies of *C. spathulata*. However, the differences separating it from *C. spathulata* s. str. are such that recognition at species rank is more consistent with my practice in the genus. Of the two available names at specific rank, I chose to take up *D. kahiliensis*, as it reflects the near-restriction of this species to Mt. Kāhili.

Similarly, the populations that I previously recognized as *Delissea sinuata* subsp. *lanaiensis* are easily as distinct from *D. sinuata* s. str. as any two species in the genus.

Delissea lanaiensis (Rock) Lammers, comb. et stat. nov. Basionym: *Delissea sinuata* var. *lanaiensis* Rock, Monogr. Stud. Haw. Lobelioid. 353. 1919. *Delissea sinuata* subsp. *lanaiensis* (Rock) Lammers, Syst. Bot. 13: 505. 1988. TYPE: Hawaiian Islands. Lāna'i: 1871, *Hillebrand s.n.* (lectotype, designated by Lammers [1988: 505], GH).

The two species may be distinguished using the following key:

1a. Lamina 25–28 cm long, oblanceolate or spatulate; petiole 7.5–12 cm long; peduncle 37–50 mm long (O'ahu) . . . . . *D. sinuata*
1a. Lamina 15–21 cm long, oblanceolate or elliptic; petiole 2.5–7 cm long; peduncle 12–15 mm long (Lāna'i) . . . . . *D. lanaiensis*

Pratia

Over the past 35 years, numerous authors (for a summary, see Lammers, 1993) have argued that recognition of *Pratia* Gaudichaud-Beaupré as a genus distinct from *Lobelia* L. was indefensible. These authors generally transferred the species indigenous to their geographic areas, but it was only recently that Murata (1995) formally merged the two genera by establishing *Pratia* and its section *Colensoa* (Hooker f.) Baillon as sections within *Lobelia*. Though most of the species currently recognized have names available in *Lobelia*, five remain that do not.

Lobelia australiensis Lammers, nom. nov. Replaced name: *Pratia prostrata* E. Wimmer, Repert. Spec. Nov. Regni Veg. 38: 3. 1935; not *Lobelia prostrata* A. Zahlbr., Bull. Herb. Boissier (ser. 2) 7: 447. 1907. TYPE: Australia. In creeks, *Cunningham s.n.* (holotype, CGE not seen).

Lobelia brevisepala (Y. S. Lian) Lammers, comb. nov. Basionym: *Pratia brevisepala* Y. S. Lian, Fl. Reipubl. Popul. Sin. 73(2): 189. 1983. TYPE: China. Yunnan: Xichou, 1500–1600 m, *Feng 11936* (holotype, PE not seen).

Lobelia macrodon (Hooker f.) Lammers, comb. nov. Basionym: *Pratia macrodon* Hooker f., Handb. New Zealand Fl. 172. 1867. TYPE: New Zealand. Acheron and Clarence Rivers, 5500 ft., *Travers s.n.* (holotype, K not seen).

Lobelia pratiana Gaudichaud-Beaupré ex Lammers, nom. nov. Replaced name: *Pratia repens* Gaudichaud-Beaupré, Ann. Sci. Nat. 5: 103. 1825; not *Lobelia repens* Thunberg, Prodr. Fl. Cap. 40. 1794. TYPE: Falkland Islands. *Gaudichaud s.n.* (holotype, P not seen).

Although Murata (1995) used this name, it was never validly published; it was merely cited by Gaudichaud-Beaupré (1829) as a synonym of *Pratia repens*.

Lobelia reflexisepala Lammers, nom. nov. Replaced name: *Pratia reflexa* Y. S. Lian, Acta Phytotax. Sinica 17(3): 123. 1979; not *Lobelia reflexa* Stokes, Bot. Mat. Med. 1: 342. 1812. TYPE: Tibet. Mo Tuo, 2700 m, *Qinghai-Xizang Exped. Team 74-3970* (holotype, PE not seen).

Campanuloideae

Two species of Campanuloideae require replacement names, because they have been known for many years by names that are later homonyms.

Campanula immodesta Lammers, nom. nov. Replaced name: *Campanula modesta* Hooker f. & Thomson, J. Proc. Linn. Soc., Bot. 2: 24. 1858; not Schott in Schott, Nyman & Kotschy, Analect. Bot. 13. 1854. TYPE: India. Sikkim: in regione alpina Himalayae orientalis, 11,000–14,000 ft., *Hooker & Thomson s.n.* (holotype, K not seen).

In order to create a new name not far removed

from the original, I have employed the antonym of the original epithet.

Wahlenbergia brehmeri Lammers, nom. nov. Replaced name: *Wahlenbergia rotundifolia* Brehmer, Bot. Jahrb. Syst. 53: 124. 1915; not (Bentham) A. DC., in DC., Prodr. 7: 425. 1839. TYPE: South Africa. Cape Province: Tafelberg, 600 m, *Schlechter 65* (holotype, B not seen).

The new name honors German botanist Wilhelm Georg Baptist Alexander von Brehmer (1883–?), who revised the African species of *Wahlenbergia* (Brehmer, 1915a, 1915b).

Literature Cited

Brehmer, W. von. 1915a. Über die systematische Gliederung und Entwicklung der Gattung *Wahlenbergia* in Afrika. Bot. Jahrb. Syst. 53: 9–71.

———. 1915b. Aufzählung der afrikanischen Arten von *Wahlenbergia* nebst Diagnosen der neuen Arten. Bot. Jahrb. Syst. 53: 72–143.

Gaudichaud-Beaupré, C. 1829. Campanulaceae. Pp. 455–459 *in* Voyage autour du Monde, Botanique. Chez Pillet Aîné, Paris.

Lammers, T. G. 1988. New taxa, new names, and new combinations in the Hawaiian Lobelioideae (Campanulaceae). Syst. Bot. 13: 496–508.

———. 1990. Campanulaceae. Pp. 420–489 *in* W. L. Wagner, D. R. Herbst & S. H. Sohmer, Manual of the Flowering Plants of Hawai'i. Univ. Hawaii Press and Bishop Museum Press, Honolulu.

———. 1992. Two new combinations in the endemic Hawaiian genus *Cyanea* (Campanulaceae: Lobelioideae). Novon 2: 129–131.

———. 1993. Chromosome numbers of Campanulaceae. III. Review and integration of data for subfamily Lobelioideae. Amer. J. Bot. 80: 660–675.

———. 1994. Typification of the names of Hawaiian Lobelioideae (Campanulaceae) published by Wilhelm Hillebrand or based upon his specimens. Taxon 43: 545–572.

———. 1995. Transfer of the southern African species of *Lightfootia*, nom. illeg., to *Wahlenbergia* (Campanulaceae, Campanuloideae). Taxon 44: 333–339.

———. In press. Review of the neotropical endemics *Burmeistera*, *Centropogon*, and *Siphocampylus* (Campanulaceae: Lobelioideae), with description of eighteen new species and a new section. Brittonia.

———, T. J. Givnish & K. J. Sytsma. 1993. Merger of the endemic Hawaiian genera *Cyanea* and *Rollandia* (Campanulaceae: Lobelioideae). Novon 3: 437–441.

Murata, J. 1995. A revision of infrageneric classification of *Lobelia* (Campanulaceae–Lobelioideae) with special reference to seed coat morphology. J. Fac. Sci. Univ. Tokyo (sec. 3) 15: 349–371.

Rock, J. F. 1919. A monographic study of the Hawaiian species of the tribe Lobelioideae family Campanulaceae. Mem. Bernice Pauahi Bishop Mus. 7(2): i–xvi, 1–395.

St. John, H. 1987. Diagnoses of *Delissea* species (Lobeliaceae) from Kauai. Hawaiian Plant Studies 145. Phytologia 63: 339–349.

———. 1988a. Diagnoses of new *Delissea* species (Lobeliaceae). Hawaiian Plant Studies 162. Phytologia 64: 165–168.

———. 1988b. More new species of *Delissea* (Lobeliaceae). Hawaiian Plant Studies 126. Phytologia 64: 172.

Nemacladoideae, a New Subfamily of Campanulaceae

Thomas G. Lammers
Department of Botany, Field Museum of Natural History, Chicago, Illinois 60605-2496, U.S.A.
Email address: lammers@fmppr.fmnh.org

ABSTRACT. Data from morphology and sequencing of the chloroplast gene *rbc*L show that Cyphioideae (Campanulaceae) as traditionally circumscribed are not monophyletic. To remedy the situation, its genera are divided among three subfamilies, one of which, Nemacladoideae, is new.

The Campanulaceae as circumscribed by Cronquist (1981) included the genera sometimes segregated as Cyphiaceae, Cyphocarpaceae, Lobeliaceae, and Nemacladaceae, but excluded *Pentaphragma* Wallich ex G. Don and *Sphenoclea* Gaertner as distinct families. Recent phylogenetic analyses support the monophyly of this circumscription. In a recent study of sequence variation in the chloroplast gene *rbc*L (Cosner et al., 1994), exemplars of all five taxa formed a clade supported by 17 synapomorphies, with a bootstrap value of 100%, while exemplars for *Pentaphragma* and *Sphenoclea* fell in other clades. Basal to this clade was *Stylidium* Swartz ex Willdenow (Stylidiaceae). Their sister relationship was supported by only 12 synapomorphies, with a bootstrap value of 72%. A subsequent analysis of morphological data (Gustafsson & Bremer, 1995) likewise supported the monophyly of these five taxa and the exclusion of *Pentaphragma* and *Sphenoclea* from the clade.

The degree of phenotypic and genotypic differentiation evident among these five taxa is not excessive when compared to many other angiosperm families of comparable size. In the interests of consistency, therefore, it is deemed best to adopt Cronquist's circumscription of the family, and to consider Campanulaceae to incorporate all five taxa. The taxonomic structure that is evident in these data sets may then be expressed at subordinate levels of the hierarchy.

It has been traditional to divide a broadly circumscribed Campanulaceae into three subordinate groups, ranked as tribes (Bentham & Hooker, 1876) or more commonly subfamilies (Schönland, 1889; Wagenitz, 1964; Wimmer, 1968): Campanuloideae, Cyphioideae, and Lobelioideae. Although the monophyly of Campanuloideae and Lobelioideae found support in the molecular analyses (the morphological analyses scored each as a single exemplar), monophyly was not supported by either analysis for Cyphioideae. This possibility was first raised by Bentham (1875), who wrote (p. 6) "We have for technical convenience placed them [*Cyphocarpus*, *Nemacladus*, and *Cyphia*] together in a small third tribe intermediate between the two others [i.e., Campanuloideae and Lobelioideae]; but, strictly speaking, they may not perhaps form a truly natural group."

As noted previously (Lammers 1992), the Cyphioideae fall into three morphologically and geographically distinct groups: *Cyphia* in tropical and southern Africa; *Cyphocarpus* in northern Chile; and *Nemacladus*, *Parishella*, and *Pseudonemacladus* in western North America. The phylogenetic analyses based on both morphology and *rbc*L sequence data showed each to be an independent lineage within the clade here treated as Campanulaceae. Thus, the Cyphioideae as traditionally circumscribed are not monophyletic. To remedy this situation, the Cyphioideae are here divided into three subfamilies. Names are available for two, but the third requires a name. A key is provided to distinguish all five subfamilies, which are fully cited below. Note that if the traditional circumscription of Cyphioideae is retained, the name Cyphocarpoideae has four years' priority.

KEY TO THE SUBFAMILIES OF CAMPANULACEAE JUSSIEU, NOM. CONS.

1a. Corolla actinomorphic; odd (unpaired) sepal in a dorsal position; locules and stigmas (1–)3–5(–10) . . . . . Campanuloideae

1b. Corolla zygomorphic, sometimes only slightly so; odd (unpaired) sepal in a ventral position prior to any floral resupination; locules and stigmas (1–)2.

2a. Flowers resupinate, the odd (unpaired) sepal in a dorsal position at anthesis; anthers connate, the dorsal 3 longer than the ventral 2 . . . . . Lobelioideae

2b. Flowers oriented normally, the odd (unpaired) sepal in a ventral position at anthesis; anthers distinct, all alike.

3a. Corolla composed of a single cucullate dorsal lobe with an apical appendage plus 4 ventral lobes; stamens all epipetalous . . . . . Cyphocarpoideae

3b. Corolla composed of 2 ± flat unappendaged ventral lobes plus 3 dorsal lobes; stamens epigynous or the dorsal two epipetalous.
4a. Perennials with tuberous roots; style tipped by a fluid-filled stigmatic cavity with a lateral pore . . . Cyphioideae
4b. Annuals (or if perennial, lacking tubers); style tipped by a bilobed stigma . . . . . Nemacladoideae

Campanuloideae G. T. Burnett, Outl. Bot. 942, 1094, 1110. 1835, "Campanulidae." TYPE: *Campanula* L.

Additional genera. *Adenophora* Fischer, *Asyneuma* Grisebach & Schenk, *Azorina* Feer, *Berenice* L. R. Tulasne, *Canarina* L., *Codonopsis* Wallich, *Craterocapsa* Hilliard & B. L. Burtt, *Cryptocodon* Fedorov, *Cyananthus* Wallich ex Bentham, *Cyclocodon* Griffith, *Cylindrocarpa* Regel, *Echinocodon* D. Y. Hong, *Edraianthus* (A. DC.) A. DC., *Feeria* Buser, *Githopsis* Nuttall, *Gunillaea* Thulin, *Hanabusaya* Nakai, *Heterochaenia* A. DC., *Heterocodon* Nuttall, *Homocodon* D. Y. Hong, *Jasione* L., *Legousia* Durande, *Merciera* A. DC., *Michauxia* L'Héritier, *Microcodon* A. DC., *Muehlbergella* Feer, *Musschia* Dumortier, *Namacodon* Thulin, *Nesocodon* Thulin, *Ostrowskia* Regel, *Peracarpa* Hooker f. & Thomson, *Petromarula* (Persoon) Ventenat ex R. Hedwig, *Physoplexis* (Endlicher) Schur, *Phyteuma* L., *Platycodon* A. DC., *Prismatocarpus* L'Héritier, *Rhigiophyllum* Hochstetter, *Roella* L., *Sergia* Fedorov, *Siphocodon* Turczaninow, *Theilera* E. Phillips, *Trachelium* L., *Treichelia* Vatke, *Triodanis* Rafinesque, *Wahlenbergia* Schrader ex Roth, *Zeugandra* P. H. Davis.

Nemacladoideae Lammers, subfam. nov. TYPE: *Nemacladus* Nuttall.

A ceteris subfamiliis Campanulacearum floribus non resupinatis, sepalo nongemino ventrali, corolla bilabiata lobis dorsalibus 3 et ventralibus 2, filamentis connatis distale, antheris distinctis, et stigmate bilobato differt.

Additional genera. *Parishella* A. Gray, *Pseudonemacladus* McVaugh.

Cyphioideae (A. DC.) Walpers, Ann. Bot. Syst. 2: 1037. 1852, "Cyphiaceae." TYPE: *Cyphia* Bergius.

Cyphocarpoideae Miers, London J. Bot. 7: 61. 1848, "Cyphocarpaceae." TYPE: *Cyphocarpus* Miers.

Lobelioideae G. T. Burnett, Outl. Bot. 942, 1094, 1110. 1835, "Lobelidae." TYPE: *Lobelia* L.

Additional genera. *Apetahia* Baillon, *Brighamia* A. Gray, *Burmeistera* Triana, *Centropogon* C. Presl, *Clermontia* Gaudichaud, *Cyanea* Gaudichaud, *Delissea* Gaudichaud, *Dialypetalum* Bentham, *Diastatea* Scheidweiler, *Dielsantha* E. Wimmer, *Downingia* Torrey, *Grammatotheca* C. Presl, *Heterotoma* Zuccarini, *Hippobroma* G. Don, *Howellia* A. Gray, *Hypsela* C. Presl, *Isotoma* (R. Brown) Lindley, *Laurentia* Adanson, *Legenere* McVaugh, *Lysipomia* Kunth, *Monopsis* Salisbury, *Porterella* Torrey, *Ruthiella* Steenis, *Sclerotheca* A. DC., *Siphocampylus* Pohl, *Trematolobelia* A. Zahlbruckner, *Unigenes* E. Wimmer.

Acknowledgments. My thanks to James L. Reveal (University of Maryland) for information on the places of publication of subfamilial names; and to William M. M. Eddie (University of Edinburgh), for his helpful review of the manuscript.

Literature Cited

Bentham, G. 1875. Notes on the gamopetalous orders belonging to the campanulaceous and oleaceous groups. J. Linn. Soc., Bot. 15: 1–16.

———. 1876. Campanulaceae. Pp. 541–564 *in* G. Bentham & J. D. Hooker, Genera Plantarum, vol. 2. Reeve, London.

Cosner, M. E., R. K. Jansen & T. G. Lammers. 1994. Phylogenetic relationships in the Campanulales based on *rbc*L sequences. Pl. Syst. Evol. 190: 79–95.

Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia Univ. Press, New York.

Gustafsson, M. H. G. & K. Bremer. 1995. Morphology and phylogenetic interrelationships of the Asteraceae, Campanulaceae, Goodeniaceae, and related families. Amer. J. Bot. 82: 250–265.

Lammers, T. G. 1992. Circumscription and phylogeny of the Campanulales. Ann. Missouri Bot. Gard. 79: 388–413.

Schönland, S. 1889. Campanulaceae. Pp. 40–70 *in* A. Engler & K. Prantl (editors), Die natürlichen Pflanzenfamilien IV.5. Engelmann, Leipzig.

Wagenitz, G. 1964. Campanulales. Pp. 478–497 *in* H. Melchior (editor), A. Engler's Syllabus der Pflanzenfamilien, ed. 12, vol. 2. Gebrüder-Bornträger, Berlin.

Wimmer, F. E. 1968. Campanulaceae-Cyphioideae. Pp. 917–1014 *in* H. Stubbe (editor), Das Pflanzenreich IV.276c. Akademie-Verlag, Berlin.

Ceropegia striata, a New Species of Asclepiadaceae in Central Madagascar

Ulrich Meve
Lehrstuhl für Pflanzensystematik, Universität Bayreuth, D-95440 Bayreuth, Germany

Patrick Siro Masinde
Institut für Botanik, Westf. Wilhelms-Universität, Schlossgarten 3, D-48149 Münster, Germany

ABSTRACT. A new species of Asclepiadaceae–Stapelieae from central Madagascar, *Ceropegia striata* Meve & Masinde, is described and illustrated. The delicate, tuberous twiner is characterized by linear corolla lobes and purplish, adaxially bulging vascular bundles resulting in the conspicuous striation of the completely whitish-greenish corolla. Due to similarities in vegetative growth and corona morphology, *C. striata* is probably nearest to *C. madagascariensis* Decaisne.

In the conspectus of the Malagasy *Ceropegia* L., Meve and Liede (1994) listed 16 species in four sections, including section *Dimorpha*, which was formally established. Except for two varieties, all new Malagasy *Ceropegia* species described since Huber's (1957) revision belong to the section *Dimorpha*—a section consisting of several groups of highly variable and seemingly closely related species. Formally, *C. striata* would belong to the section *Janthina* of which *C. madagascariensis* is the type species. However, this section sensu Huber (1957) is an assemblage of not always closely related species and is therefore in urgent need of recircumscription. On Madagascar, *C. striata* is to be grouped with other twining species having a root tuber, thin and herbaceous stems, and membranous leaves, namely, *C. humbertii* H. Huber, *C. madagascariensis* Decaisne, *C. saxatilis* Jumelle & H. Perrier, and *C. scabra* Jumelle & H. Perrier.

Ceropegia striata Meve & Masinde, sp. nov. TYPE: Madagascar. Central highlands, Vavavato Massif, ca. 22 km W Antsirabe, Betafo, 19°45′S, 46°55′E, 1800 m a.s.l., 21 Dec. 1995, *Grubenmann s.n.* (holotype, ZSS; isotype, MSUN, in spirit). Figure 1.

Affinis *C. madagascariense* Decaisne sed corolla albaviridi cum striis purpureis longistrorsis, lobis corollae angustis atropurpureis, ciliatis densis praeter margines, tubo corollae basaliter globuloso, corona glabra, lobis coronae staminalis spathiformibus planis, albis sed basaliter purpureis differt.

Plant delicate, geophytic climber, herbaceous. *Rootstock* roundish, flattened tuber, ca. 20–28 mm diam., smooth, light brown. *Stems* herbaceous, deciduous, rarely branching, 1.0–2.5 mm diam., green with reddish tinge when exposed to direct sunlight, twining, glabrous. *Leaves* shortly petiolate, petiole 1–2 mm long, less than 1 mm wide, ±straight, canaliculate above, stipules minute, subulate, short-lived; leaf blades linear-elliptic to small lanceolate, acute, 10–30 × 5–8 mm, membranous, green, glabrous except for few recurved hairs along margins. *Inflorescence* extra-axillary, usually 1-flowered, subsessile with peduncle less than 1 mm long, 1 accompanying bract lanceolate-subulate, acute, ca. 1 mm long, pedicel ± 5 mm long. *Sepals* lanceolate, flattened and appressed to corolla tube, ± 1 mm long. *Corolla* 25–35 mm long, abaxially glabrous; basal third of tube forming globoid inflation, ca. 7 × 6 mm, merging into narrow, cylindrical, ascending upper half of tube with conical mouth, ca. 12–15 mm long, basally 1–2 mm wide, apically 6–8 mm wide. Tube abaxially and adaxially whitish-greenish, with purplish adaxially bulging bundles, tube segments and each lobe contain 3 anthocyanin-pigmented bundles, each with central bundle strongest, pigmentation of each bundle restricted to outer phloem parenchyma plus an additional subcuticular stripe of parenchyma, tube glabrous except for ring of weak, descending hairs around mouth of tube; corolla lobes linear, ca. 10 × 0.7 mm, erect, joined at apex, margins only slightly recurved, abaxially green, adaxially black-purple, margins densely lined with purplish (only basally whitish) trichomes, trichomes slightly vibratile, ±1 mm long, somewhat moniliform in outline. *Gynostegial corona* in total ±3.5 × 3.5 mm, cup-shaped; staminal corona lobes connivent-erect, spathulate, abaxially slightly convex, adaxially slightly concave, 2–2.5 × 0.6–0.7 mm, glabrous, whitish

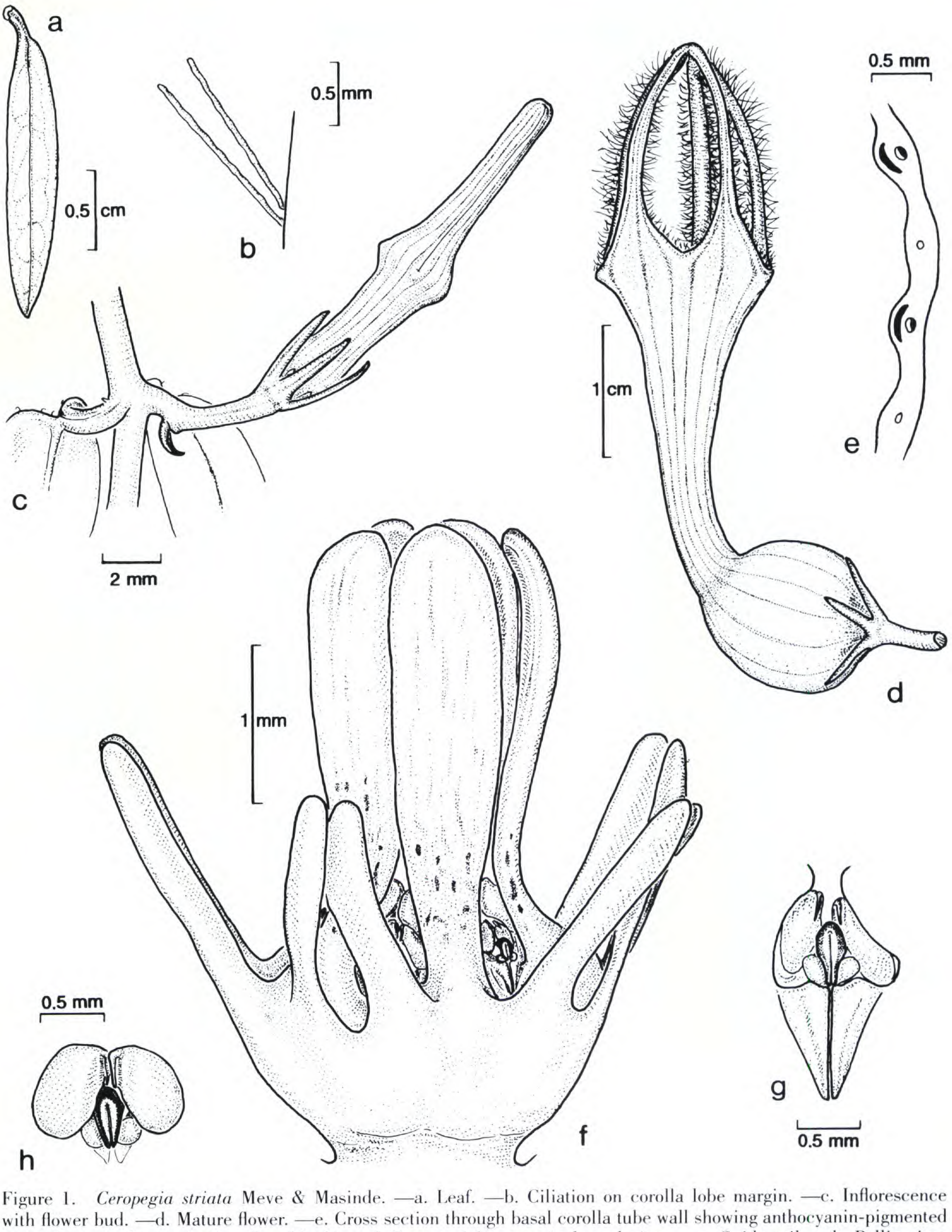


Figure 1. *Ceropegia striata* Meve & Masinde. —a. Leaf. —b. Ciliation on corolla lobe margin. —c. Inflorescence with flower bud. —d. Mature flower. —e. Cross section through basal corolla tube wall showing anthocyanin-pigmented parenchyma and vascular bundles (black). —f. Gynostegial corona in lateral view. —g. Guide rail. —h. Pollinarium (drawn by U. Meve from the type, *Grubenmann s.n.*).

with purplish bases, occasionally the bases spotted purplish, interstaminal corona parts bifid, connivent, suberectly spreading, ±linear with rounded apex, ±1.5 × 0.3 mm, glabrous, whitish, purplish only on adaxial basal half. *Gynostegium* subsessile, whitish, guide rails ± 400 μm long, straight without being widened at their mouths. *Pollinarium*: corpusculum obovate, ±200 × 80 μm, basally with roundish, translucent lateral projections; pollinia broadly elliptic, ±300 × 150 μm.

Table 1. Differences in the distinguishing characters of *Ceropegia striata* and *C. madagascariensis*.

Characters	*C. striata*	*C. madagascariensis*
Stem	No formation of stem tubers	Sometimes with stem tubers at nodes
Leaves	Linear-elliptic, petioles 1–2 mm long	Ovate, petioles 7–20 mm long
Corolla coloration	Purple striated	Faintly spotted reddish brown
Basal inflation of corolla tube	Basal ⅓ inflated	Basal ½ inflated
Corolla lobes	Linear, not considerably folded back	Triangular, considerably folded back
Staminal corona lobes	Spathulate, apically smooth	Linear-clavate, apically verrucose
Interstaminal corona lobes	Glabrous	Hairy

Habitat and conservation status. On granite hillock, at 1800 m, tubers somewhat exposed in pouches filled with humus-rich sand. A rare Malagasy endemic known only from the type locality in central Madagascar.

The diagnostic features for *Ceropegia striata* are: the connivent-erect, spathulate staminal corona lobes; the purplish or at least purplish mottled corona, except for the upper part of the staminal lobes; a complete striation of the corolla due to the adaxially bulging bundles pigmented with anthocyanin; and the small, linear, black-purple, slightly recurved corolla lobes, which are densely ciliated along their margins. *Ceropegia striata* is easily distinguishable from *C. madagascariensis* (Table 1), which probably represents its closest known relative. The biseriate corona with its connivent-erect staminal lobes and the interstaminal lobes deeply indented, more or less to the base, is rather similar in both species. In addition, staminal corona lobes are about twice as long as the interstaminal lobes.

As in the two taxa discussed above, *Ceropegia saxatilis*, *C. scabra*, and *C. humbertii* also have rounded root tubers in combination with a herbaceous plant body. However, all three species have flowers without purplish striations and differently shaped corollas and corolla lobes. Their staminal corona lobes are linear-clavate and less than twice as long as the interstaminal lobes.

Ceropegia hermannii was recently described by Rauh and Teissier (1996) and placed in close relationship with *C. madagascariensis*. However, *C. hermannii* is actually a member of the variable *C. albisepta* complex. The following characters in *C. hermannii* support this placement: the long internodes; the sub-succulent often mucronate leaves; the considerably stalked, fleshy, many-flowered inflorescences; the basally broadly keeled corolla lobes; the basal inflation with 5 vague indentations; and the abruptly narrowed tube, so that the basal inflation has a rather horizontal roof.

The five species, *Ceropegia humbertii*, *C. madagascariensis*, *C. saxatilis*, *C. scabra*, and *C. striata*, form a natural grouping as well as the basis of section *Janthina*, since the type species of this section is included. Further investigations with ample material are needed to establish whether there are other species that belong to this group.

Acknowledgments. Moritz Grubenmann, Zürich, and Hans Rentsch, Saas, the discoverers of the new species, collected the resting tuber, erroneously taking it for a *Cynanchum* species. Later in Zürich, the plant flowered, revealing its identity. We thank Mr. Grubenmann for providing us with slides and alcohol material of *C. striata*. Peter Deitelhoff, Münster, corrected the Latin diagnosis. We are grateful to Focke Albers, in whose laboratories the investigations were undertaken.

Literature Cited

Huber, H. 1957. Revision der Gattung *Ceropegia*. Mem. Soc. Brot. 12.

Meve, U. & S. Liede. 1994. A conspectus of *Ceropegia* L. (Asclepiadaceae) in Madagascar, and establishment of *C.* sect. *Dimorpha*. Phyton 34: 131–141.

Rauh, W. & M. Teissier. 1996. *Ceropegia hermannii* Rauh & Teissier—Une espèce nouvelle du sud-ouest de Madagascar. Succulentes (France) 19(4): 22–25.

NOTE ADDED IN PROOF:

Recently, Werner Rauh, Heidelberg, provided us with paratypic material of *C. striata* [Madagascar. Central Highlands: above Antsirabé, *Rauh 75008* (HEID; MSUN, in alc.)]. This plant has smaller leaves (1.0–3.0 mm) than the type, and the corolla lobes are shorter and broader with the apical half green and glabrous.

A New and an Emended Species of *Mouriri* (Melastomataceae)

Thomas Morley

Department of Plant Biology, University of Minnesota, St. Paul, Minnesota 55108, U.S.A.

ABSTRACT. A new species of *Mouriri*, *M. laxiflora*, from eastern Ecuador is described and illustrated, and a description of *Mouriri crassisepala* of the Dominican Republic is revised to include flowering material, with illustrations of the flowering parts.

Mouriri laxiflora Morley, sp. nov. TYPE: Ecuador. Napo: Aguarico, Reserva étnica Huaorani, carretera y oleoducto de Maxus en construcción, Km 71, al sur del rio Tivacuno, bosque humedo tropical, bosque primario, colinas de suelos rojos, 0°50′S, 76°19′W, 250 m, 15–25 Jan. 1994 (fl), *Milton Aulestia & I. Ima 1575* (holotype, MO; isotypes, MIN, QCNE). Figure 1.

Arbor usque 14 m alta; ramuli juvenes teretes; superficies costae mediae plana; cryptae stomatophorae nullae; hypodermis absens; inflorescentiae cauliflorae, singulae 3–18-florae; calyx ovarium inferior includens 9–11 mm longus, lobi $\frac{9}{10}$ connati usque ad anthesem, tum ad lineas conjunctionis loborum rumpens, 4.5–4.7 mm longi ab staminibus, quadrati usque trapezoidei, truncati et apiculati; petala purpurea; antherae 5.7–6 mm longae, thecae 5.6–6 mm longae, rimis apicalibus dehiscentes; glandula 0.4–0.5 mm longa; ovarium 5-loculare, ovula 20–25; fructus subglobosus, calyce coronato; semina ca. 5–7, 14.5–15 mm alta.

Tree to 14 m high, the trunk to 15 cm diam.; odor astringent; latex scanty, watery-creamy; young twigs with rounded angles; plants glabrous except for the inflorescence. Petioles 2–4 mm long; blades 10–16.5 cm long, 3–5.7 cm wide, elliptic or narrowly so to slightly ovate-elliptic, obovate-elliptic, or ovate-oblong, abruptly acute to acuminate at the apex, acute to rounded or abruptly so or abruptly truncate to slightly cordate at base; midrib plane above, rounded below at base, becoming rectangular away from the base; lateral nerves conspicuous above and below when dry. Midrib xylem tubular; stomatal crypts none; upper epidermis nearly unpigmented with few chloroplasts, varying from 1 to 2 cells thick in the same leaf, mucilaginous walls common, mostly in the inner cells where double, sometimes in the single cells; hypodermis none; terminal sclereids stellate-columnar. Inflorescences borne on the trunk, 1 or 2 per side, each 3–18-flowered, 29–110 mm long to base of farthest pedicel measured along the axes and with 3–5 internodes in that distance, the branchlets puberulent, the lateral branchlets flattened, 1.2–2.2 times as wide as thick; bracts 2–4 mm long, triangular, acute, perfoliate at base. Young flower buds green, becoming cream; flowers pentamerous; true pedicels 3–8 mm long, expanded at the apex, puberulent; calyx including inferior ovary 9–11 mm long, ellipsoid to obovoid, dark reddish brown to reddish black when dry, sparsely puberulent to nearly glabrous, the petals not protruding at the apex till the bud is full size; calyx lobes initially triangular, 0.8–1.5 mm long, ca. 1.0 mm wide, becoming low triangular to truncate and apiculate as the bud enlarges, stretching to 2.2–3.3 mm wide just before the calyx splits; as separation of the lobes occurs, all lobes become truncate and apiculate at the apex often with some retraction of the central apiculum and elevation of the torn shoulders creating a slight reverse curve on each side of the apiculum; lobes splitting apart a distance of 2.5–4.5 mm at anthesis, then quadrate to trapezoidal, 4.5–4.7 mm long from top of stamen scar, 3.6–5.8 mm wide at base, to 6.2 mm wide in fruit, 1.7–3 mm wide at apex, 3–4.5(–5) mm wide 1 mm below the apex; free hypanthium 4.5–5.5 mm long. Petals purple, broadly elliptic, 12–14 mm long, 7–8 mm wide, acute to abruptly so at apex, with a tapering claw 1 mm long at base. Stamens purple, the filaments 11–13 mm long; anthers (cleared and expanded in NaOH) 5.7–6 mm long, 2.6–2.7 mm wide; thecae 5.6–6 mm long, dehiscing by apical slits; gland 0.4–0.5 mm long, 3.5–4 mm from apex of anther when measured from center of gland; cauda none; anthers when dry 5.2–5.5 mm long, then narrower (theca to gland) than above, the shrinkage changing the overall appearance and increasing the width of the pores. Ovary 5-locular; ovules axile-basal, produced only outwardly from each placenta, 3–5 per locule, 20–25 in all; style 20–25 mm long; fruits subglobose, crowned with the calyx, 20–24 mm high excluding hypanthium and calyx, 20–32 mm diam., the hypanthium cavity 6–6.5 mm diam., 3.5–4 mm deep from bottom to base of filament scar, the base concave to flat, the style scar 1–1.5 mm diam., the walls vertical, the anther ridges at top of hypanthium 2–2.5 mm apart, the lower edge of the over-

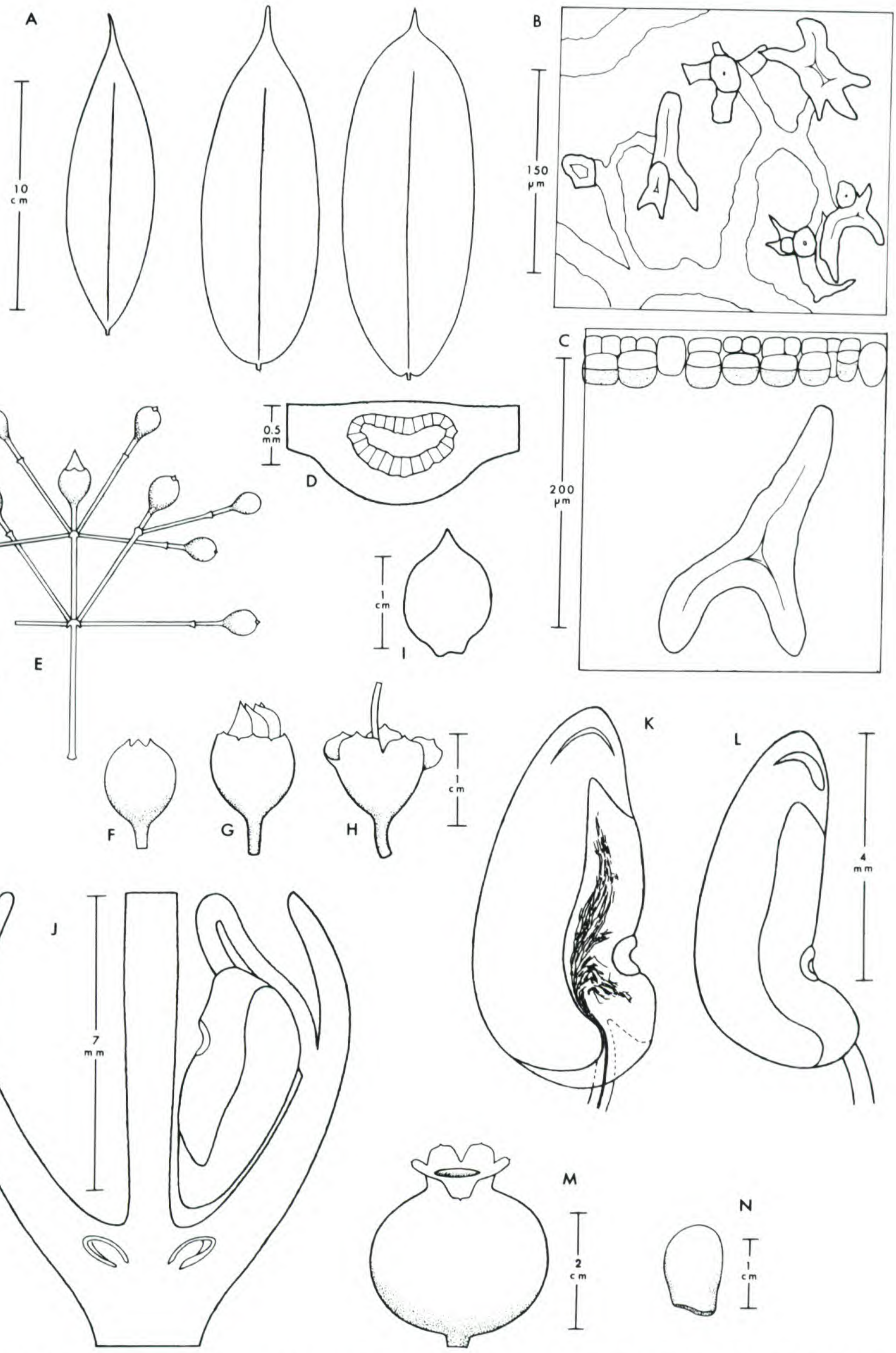


Figure 1. *Mouriri laxiflora* Morley. —A. Leaves from various collections. —B. Cleared part of leaf blade showing veins and terminal sclereids (*Dik 883*). —C. Cross section of leaf blade showing sclereids and upper epidermis (*Dik 883*). —D. Cross section of leaf midrib (*Aulestia 1514*). —E. Inflorescence (*Dik 883*) —F–H. Stages in expansion

hanging rim near the top of the hypanthium (inner abscission line?) from contacting the lower edge of the antesepalous stamen scar to 0.7 mm below it, with a fringe of tiny white papillae. Seeds ca. 5–7, 14.5–15 mm high, 9–10 mm wide radially, 5.9–9.2 mm thick, flattened on the contact faces, medium to dark brown, polished, with a rough flattish basal hilum 5 mm long, 3–4 mm wide from nearly horizontal to angled at 45°.

Reproduction. Flowering, December–January; fruiting, April–May.

Distribution. Primary tropical forests of east Ecuador, often hilly land with red soil; 230–250 m.

Local names. Huaorani, *emuyno, emoihue*; Quichua, *sacha mulchi.*

The new species falls in the subgenus *Mouriri* and section *Olisbea* of the genus. Characters placing it in subgenus *Mouriri* are its tubular midrib xylem, axile-basal placentation, polished seeds, common mucilaginous walls in the upper epidermis, and purple petals. It belongs in *Olisbea* on the basis of its lack of stomatal crypts in large leaves, pentamerous flowers with long anthers and anther thecae, calyx lobes nearly fully fused with petals not protruding till the bud is full size, and the long splitting distance of the calyx lobes at anthesis. The new species is distinguished from all others in the group by the combination of its mostly acute to rounded leaf bases, plane upper midrib, lack of stomatal crypts, presence of mucilage walls in the upper epidermis, large open inflorescence, regular separation of the tips of the calyx lobes in bud, broad squarish calyx lobes at anthesis, and unlobed fruit with persistent calyx.

Of the other species, *Mouriri laxiflora* is most similar to *M. grandiflora* DC. and *M. tessmannii* Markgraf. *Mouriri tessmannii* is especially suggestive as a relative because of its unpigmented upper epidermis, similar anther form, and geographic proximity. However, *M. laxiflora* differs in its much larger inflorescence, larger bracts of the inflorescence, regular calyx lobes which become truncate and apiculate at anthesis and which are 3–5 mm wide 1 mm below the end of the lobe compared to 1.8–2 mm wide at that point in the ovate-triangular lobes of *M tessmannii*; the latter plant also has a fruiting hypanthium 4–5 mm in diameter and 5.5 mm deep with the lower edge of the overhanging rim near the top of the inner hypanthium 0.7–2 mm below the antesepalous stamen scar, compared to the measurements given above for *M. laxiflora;* and the overhanging rim of *M. tessmannii* lacks a fringe. The new species differs from the widespread *M. grandiflora* in the former's nearly unpigmented upper epidermis, much larger inflorescence, and truncate and apiculate calyx lobes at anthesis compared to the triangular to rounded ones in *M. grandiflora* which are 1.5–2.8 mm wide 1 mm below the apex; the 20–25 ovules, seeds 14–15 mm high, and fully persistent calyx in *M. laxiflora* also differ from the 15–19 ovules, seeds 8–11 mm high, and more or less deciduous fruiting calyx of *M. grandiflora.*

Paratypes. ECUADOR. **Napo:** Aguarico, Reserva Etnica Huaorai, carretera y oleoducto de Maxus en construcción, Km 67–69, colinas de suelo rojo, 0°49′S, 76°22′W, 250 m (buds & fls), *M. Aulestia, N. Andi, E. Nenquerei 1514* (MIN, MO, QCNE); Orellana, Parque Nacional Yasuni, carretera y oleoducto de Maxus en construcción, Km 9–11, 0°29′S, 76°33′W, 230 m, 14 Dec. 1993 (buds & fls), *A. Dik 883* (MIN, MO, QCNE); Km 19, 0°33′S, 76°31′W, 230 m, 1–27 Apr. 1993 (frs), *F. Hurtado 3100* (MIN, MO, QCNE), *F. Hurtado 3167* (MIN, MO, QCNE); Km 20, 0°33′S, 76°30′W, 250 m, 28–30 July 1993 (fl buds), *M. Aulestia & G. Grefs 184* (MIN, MO, QCNE).

Mouriri crassisepala Morley, expanded description. Figure 2.

Originally collected and described only in fruit, plants of the species were collected in flower in 1993, necessitating an expansion of its description. Italicized words are additions to the original description (Morley, 1993) made from the new material.

Small erect tree to 12 m high, glabrous except for the inflorescence; young twigs round to 4-angled or rarely with small ridges at the angles. Petioles 1.5–3.5 mm long, *blades 13–25 times the petiole length,* 2.7–4.8 cm long, 1.7–3.3 cm wide, 0.36–0.48 mm thick, elliptic to ovate-elliptic, the margin strongly revolute, the apex rounded or seeming broadly acute through revolution of the margins, rarely mucronate, the base acute to broadly so; midrib plane above, plane to very low rounded or very low-rectangular or with two low lateral ridges below; lateral nerves not visible. Midrib xylem tubular; stomatal crypts usually Type III (Morley, 1976), Type II when small, averaging 60–*71* μm diam, 28–35 μm high, *25*–42 per sq. mm (extremes 35–*100* μm diam., 25–40 μm high, *15*–57 per sq. mm); upper epidermis 1–2 cells thick; mucilage

←

of flower buds (*Aulestia 1575*). —I. Petal (*Aulestia 1575*). —J. Lengthwise section of flower bud (*Aulestia 1575*). —K. Anther expanded in NaOH, presumably equivalent to the fresh condition (*Aulestia 1575*). —L. Dry anther (*Aulestia 1575*). —M. Fruit (*Hurtado 3167*). —N. Seed (*Hurtado 3167*).

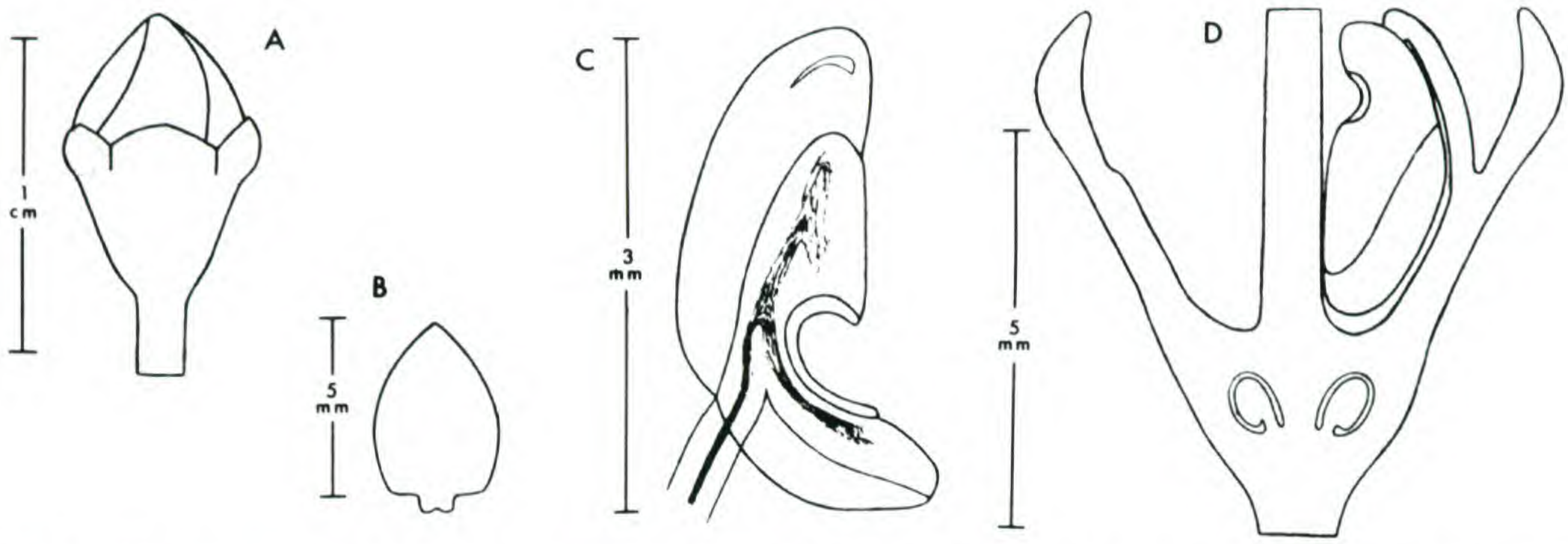


Figure 2. *Mouriri crassisepala* Morley. —A. Flower, boiled (*Mejia 2210*). —B. Petal (*Mejia & Montilla 2213*). —C. Anther, cleared in NaOH (*Mejia & Montilla 2213*). —D. Lengthwise section of flower (*Mejia 2210*).

walls none; hypodermis present; terminal sclereids from stellate with a horizontal central body and columnar branches to thick-columnar with branches at each end and no central body. Flowers *on the new branches*, mostly terminal, seldom in the upper axils; peduncles 1–2 per side, each 1–*5-flowered*, 3–*29* mm long to base of most distal pedicel measured along the axes and with 1–3 internodes in that length; bracts deciduous in *flower*. True pedicels 1.5–*7* mm long, they and the axes of the inflorescence minutely puberulent or granular to glabrous; *flower buds whitish-rose; calyx including inferior ovary obconic, 5–6 mm long, minutely puberulent on the upper hypanthium; free hypanthium 2–2.3 mm long; calyx lobes just before anthesis low-triangular, spongy-thickened when boiled and presumably when fresh, drying flatter, 0.5–1.0 mm long, 1.9–3.3 mm wide, 2–2.4 mm long from stamen attachment*, the calyx characters slightly different in fruit (see below), *splitting distance between adjacent lobes at anthesis 0.8–1.4 mm. Petals white with the lower midnerve red, 5–6 mm long, 3.5 mm wide, ovate, acute at apex, truncate at base with a claw 0.5 mm long, minutely puberulent, containing numerous druses. Anthers 3–3.7 mm long, the thecae yellow, dehiscing by apical slits, 2.3–2.6 mm long; gland 0.6–0.8 mm long, 2–2.7 mm from apex of anther when measured from center of gland. Stigma lilac, showy; ovary 3(–4)-locular, the locules separate, the ovules axile-basal, produced only outwardly from each placenta, 8–10 in all. Fruits green and yellow when mature*, crowned with the calyx, 1–4-seeded, subglobose when 1-seeded, then 14–22 mm diam., lobed according to the number of seeds when seeds more than 1, up to 32 mm diam. when seeds 2–4, the dry measurements ca. 25% less; calyx lobes in fruit 1.5–1.9 mm long from stamen attachment, 2.4–3.2 mm wide, 0.3–0.7 mm thick, rounded; petal and stamen scars dark, barely or not discernible, flush with the surface; petal scars 1.3–1.5 mm long (radially), 1.3–1.4 mm wide (circumferentially) or indistinct; antesepalous stamen scars 0.3–0.5 mm long, 0.8–1.2 mm wide, the antepetalous ones 0.4 mm long and 0.6 mm wide or indistinct; style scar 1.5–2.5 mm diam.; inside diameter of base of fruiting hypanthium 4.2–6.6 mm, less at apex, the walls thus overhanging, the overhang great in 1-seeded fruits, less in several-seeded ones; apex of fruit within hypanthium convex to flat. Seeds medium to dark brown, smooth, 14–16.5 mm long, 12.5–15.5 mm wide, 10–14 mm thick, subglobose or flattened on the contact faces when more than 1, with a roundish to angled basal hilum 5–7 mm diam.

This species was adequately distinguished from its close relatives when published with the possible exception of *M. gonavensis* Urban & Ekman, which is known only from flowering material. The distinctions from the latter species as then known were stated on p. 276. The new material adds to these distinctions with the following comparisons; as before, the first statement refers to *M. crassisepala*, the second to *M. gonavensis*: calyx lobes thickened vs. unthickened; petals containing numerous druses vs. no druses seen; anther thecae 2.3–2.6 mm long vs. 2.0–2.3 mm long; ovary locules 3–4 vs. 2–3; ovules attached axile-basally vs. axile at a point ⅓–½ of the locule height above the base.

Additional specimens examined. DOMINICAN REPUBLIC. **La Vega:** Cordillera Central, Loma La Sal, 40 minutos antes de llegar al Rio Camú, en el camino La Sal a Loma El Col, 1200 m, 13 July 1993 (fls), *M. Mejia 2210* (JBSD, MIN); Loma La Meseta, Reserva Científica Ebano Verde, 1150 m, 14 July 1993 (fls), *M. Mejia & T. Montilla 2213* (JBSD, MIN).

Literature Cited

Morley, T. 1976. Memecyleae (Melastomataceae). Fl. Neotrop. 15: 1–295.

———. 1993. A new *Mouriri* (Melastomataceae) from the Dominican Republic. Novon 3: 274–277.

Ecuadendron (Fabaceae: Caesalpinioideae: Detarieae): A New Arborescent Genus from Western Ecuador

David A. Neill
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. A new genus and species of trees from mesic forests of lowland western Ecuador, *Ecuadendron acosta-solisianum*, is described. The new taxon is a canopy tree and is known from only three localities separated by a gap of 350 km. *Ecuadendron* is placed in the "*Brownea* group" of the tribe Detarieae (Fabaceae: Caesalpinioideae), and its closest relatives appear to include the monotypic *Brachycylix* from north-central Colombia, and *Heterostemon* and *Elizabetha* from the Guayana Shield area. With its long pendent inflorescences and particular suite of floral features, *Ecuadendron* appears to be adapted to pollination by bats.

The lowlands of western Ecuador, between the Andes Mountains and the Pacific Ocean, have become known as a region of high species richness and relatively high endemism for vascular plants (Dodson & Gentry, 1991). The region has been considered as one the world's most critical conservation "hotspots" for tropical forests, where high biological diversity and high rates of habitat destruction coincide (Myers, 1988).

Species-level endemism for vascular plants in the mesic forests of western Ecuador has been estimated at 20% of an estimated total flora of 5300 species (Neill, 1997). Endemism at the generic level has not yet been reported for western Ecuador, although some mesic-forest genera are shared only with the adjacent Chocó region of southwestern Colombia, and some dry-forest genera are shared only with adjacent northwestern Peru.

Recent botanical explorations in the mesic forests of western Ecuador have resulted in collections of a large canopy tree legume, which is described herein as a new genus and species in the tribe Detarieae (Fabaceae: Caesalpinioideae).

Ecuadendron acosta-solisianum D. A. Neill, gen. et sp. nov. TYPE: Ecuador. Azuay: Cantón Cuenca, Manta Real, at western base of Andes, 20 km SE of La Troncal, on lower slopes just above the village, primary forest remnant trees in cocoa plantation, Tropical Wet Forest life zone, 350 m, 02°34′S, 79°21′W, 7 Nov. 1995 (fl), *David Neill, H. Vargas, T. Núñez & J. Clark* 10437 (holotype, QCNE; isotypes, AAU, COL, GB, GUAY, K, NY, MEXU, MO, QCA, US).

Arbores Fabaceae Caesalpinioideae tribui Detarieis pertinentes. Folia paripinnata; petiolulis plicatis; foliolis bijugatis. Inflorescentia racemosa pendula; 2 m longa; bracteolis cupulatis. Flores resupinati; hypanthio cupulato; sepalis 4 cochleariformibus; petalis 5 clavatis, petalo inferiore ad basim incrassato; staminibus fertilibus 5 exsertis, staminodiis 4, filamentis ad basim connatis, hypanthio adnatis. Legumen pendulum lignosum velutinum; seminibus 4–9 oblongis vel quadrangulis.

Trees attaining 30 m, with dense oval crown; trunk to 50 cm DBH; bark light brown, mottled, peeling in flakes 1 cm diam., revealing darker blotches; slash reddish, with no detectable odor; wood dense and very hard; branchlets light brown, lenticellate. Stipules falcate-subulate, 5–8 mm long and 3 mm wide at base, irregularly caducous or often persistent, becoming somewhat lignified and covering the axillary bud, externally nerveless, minutely puberulent; leaves paripinnate, eglandular; petioles 7–15 mm long with basal pulvinus ca. 5 mm long, rachis 3–6 cm long, terete; petiolules 5–7 mm long, pulvinulate throughout their entire length and twisted or plicate (folded 180°), the leaflets thus disposed in a single plane but effectively resupinate; leaflets bijugate, chartaceous to thinly coriaceous, bicolorous, paler beneath, slightly arcuate, unequal in size, the margins entire; blade of basal pair 4–16 cm long, 2.7–7 cm wide, elliptic, inequilateral, the base acute with the upper margin meeting the costa at a point above the lower margin, apex bluntly acuminate, with 6–8 pairs of secondary veins; blade of distal pair somewhat more strongly arcuate and inequilateral than the basal pair, oblong to elliptic-oblong, widest near the apex, 13–25 cm long, 4–8 cm wide, base cuneate to acute, apex bluntly acuminate, with 11–14 pairs of secondary veins; costa and secondary veins slightly depressed above, strongly salient beneath. Inflorescence a pendent, axillary or ramuligerous, pedunculate raceme up to 2 m long; peduncle 25–60 cm long, the floriferous axis up to 1.6 m long with up to about 50 flowers arranged spirally, a single flower at each node but sometimes 2 or 3 nodes occurring close together on opposite sides of the axis; bracts absent; pedicels ca. 7 mm long; the 2 bracteoles 6–8 mm long, rounded at apex, almost

completely connate to form a broad cupular structure 7 mm wide. Flowers resupinate, such that the vexillar petal is held in the lowermost (adaxial) position; bracteoles, hypanthium, and calyx rose to brick-red; petals, androecium, and style ivory-colored; all floral parts glabrous except for velutinous ovary; hypanthium a broad thick-walled tube ca. 10 mm long; sepals 4, strongly imbricate in bud, 1.7 cm long, 1.5 cm wide at base, broadly rounded at apex, cochleariform; petals 5, clavate, 3.0–3.5 cm long, ca. 2 cm wide at widest point, broadly rounded at apex, the lowermost petal distinctly thickened at base with claw ca. 4 mm wide and 2 mm thick, the dorsal and lateral petals less strongly thickened at base; androecium of 5 fertile stamens alternating with 4 staminodes, these all connate at base into a cupular structure adnate to the hypanthium, free filaments of fertile stamens 3.0–3.2 cm long, ca. 2 mm thick, the anthers versatile, oval, ca. 10 mm long, ca. 3 mm wide, free filaments of staminodes 0.8–1.0 cm long, ca. 1 mm thick; pollen subspheroidal, tricolpate, ca. 35 μm diam., with coarsely verrucate ornamentation; gynoecium adnate to hypanthium at base, free portion 2.5–3.0 cm long; style 7–10 mm long, ovary 10 mm long, velutinous; gynophore 5–8 mm long, thickened at basal attachment to hypanthium. Pods pendulous from elongate peduncles, ligneous, 20–25 cm long, 4–5 cm wide, straight, the margins thickened, valve-faces ornamented with obliquely transverse ridges, rufescent-puberulous; seeds usually 4–9, compressed, oblong in outline or sometimes quadrangular due to pressure from adjacent seeds, 2–3.0 cm × 2.5–5.0 cm; testa thin, chartaceous, dark brown, when dry becoming brittle and separating easily from the cotyledons; aril and endosperm absent. Figures 1, 2.

Etymology. The generic name combines the name of the country of origin (Ecuador signifies "equator" in Spanish) with the Greek word for tree, *dendron*. The specific epithet commemorates Misael Acosta-Solís (1910–1994), Ecuadorian botanist and prolific writer, who carried out botanical inventories throughout Ecuador, promoted the science of botany and conservation of natural habitats, and published independently a number of works on the flora, vegetation, phytogeography, and useful plants of his native country.

Distribution and habitat. This species is known from only three localities in western Ecuador. The two southern populations are at about 2°30′S latitude: on the lower foothills of the Andes, just above the coastal plain, above the village of Manta Real in Azuay province (bordering on Cañar province; the exact provincial boundary is not clearly marked); and on the summit of Cerro Cimalón, an isolated hill to the west of the Andes near the Gulf of Guayaquil, within the Manglares-Churute Ecological Reserve in Guayas Province. At both these southern localities, *Ecuadendron acosta-solisianum* becomes a large canopy tree and is locally common within a very limited elevation range (about 300–350 m), but no more than about 50 trees are known to occur in each of the southern populations. The tree was first reported from Manta Real by R. Foster (in Parker & Carr, 1992) as a "possibly new species of *Browneopsis*." The northern locality, in Esmeraldas province on the western slopes of the coastal range (Cordillera de Mache), is at about 0°30′N, 350 km north of the two southern localities; the abundance of this species at the northern locality is unknown. All three sites are in wet to moist lowland tropical forest with considerable fog-associated precipitation. Most of the forests on the lower Andean foothills, and virtually all of the forests on the coastal plains in western Ecuador have been completely cleared for agricultural development during the past 50 years (Dodson & Gentry, 1991). It is possible, however, that additional populations of *Ecuadendron* are still extant in forest remants in the 350-km gap between the known southern and northern populations. Only the population within the Manglares-Churute Ecological Reserve has formal protection at present; forest clearing by farmers at the other two sites could exterminate those populations within a few years. At Manta Real the hard, dense wood is sometimes used in general construction, and the tree is known locally as "guabo jiche."

Phenology and pollination. Flowering specimens of *Ecuadendron acosta-solisianum* have been collected in the months of July, August, November, and December; at Manta Real the species flowered in July 1991 and 1993 but not in July 1995; in the latter year it flowered in November–December. There is, therefore, no clear-cut pattern of flowering phenology. Based on observations at Manta Real, fruits mature at about 5 months after flowering.

The long inflorescences pendent from stout branches, the gaping form of the flowers with exserted anthers, and the flower coloration, all strongly suggest that *Ecuadendron* is adapted to pollination by bats. The flowers are resupinate such that the vexillar petal is held in the lowermost (adaxial) position, and this petal is thickened and strengthened at the base; these features suggest that the adaxial petal may function as a landing platform for bats. The long pendent inflorescences and the form and position of the flowers, in fact, are reminiscent of those of *Kigelia africana* (Lamarck) Bentham (Bignoniaceae), the well-known and widely culti-

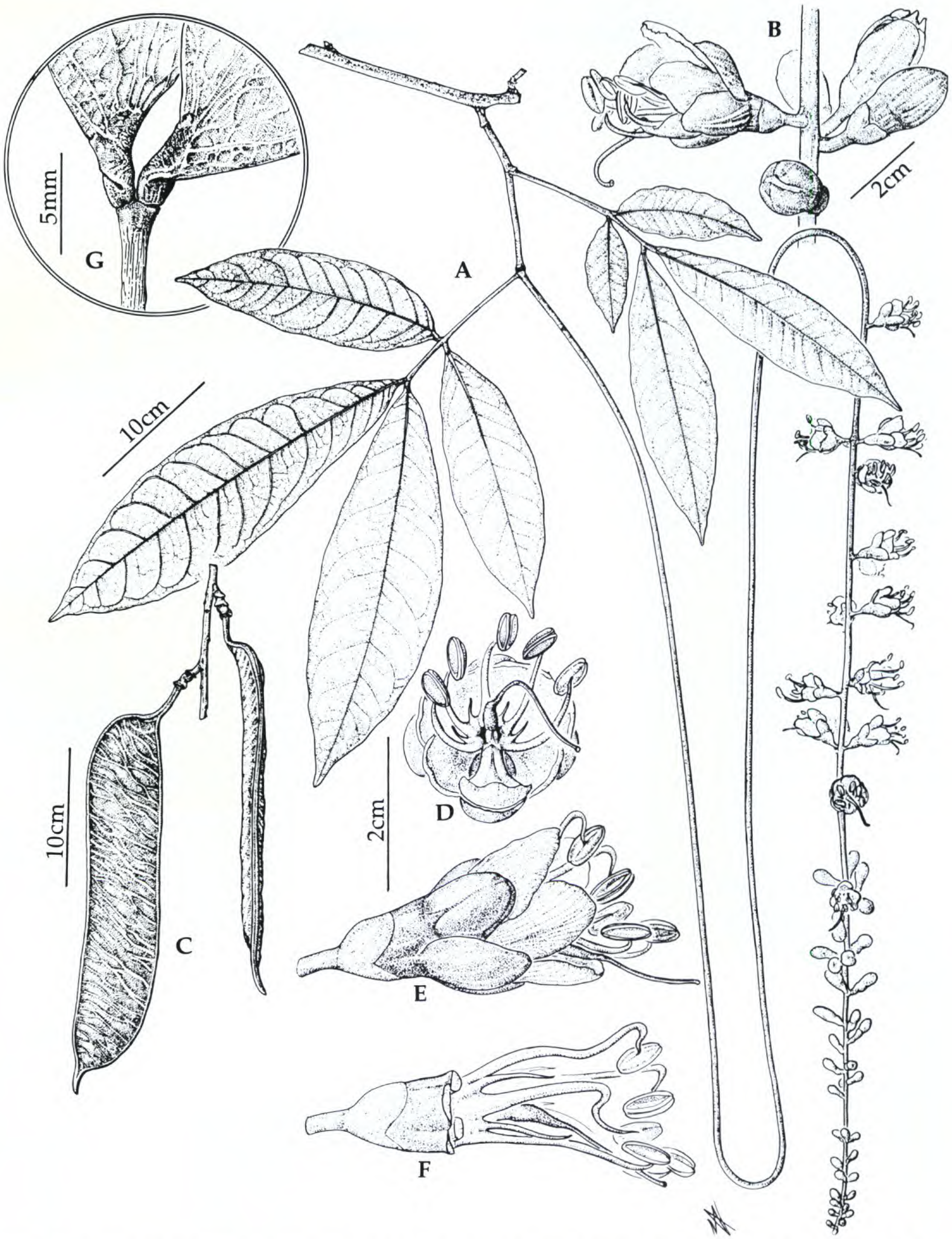


Figure 1. *Ecuadendron acosta-solisianum* D. A. Neill. —A. Flowering branch with pendent inflorescence. —B. Position of flowers on pendent inflorescence. —C. Pendent, mature fruits. —D. Open flower showing position of petals, androecium, and gynoecium. Note thickened base of lowermost petal. —E. Side view of open flower. At full anthesis, filaments are fully extended. —F. Flower with sepals and petals removed, showing position of androecium with fertile stamens and vestigial staminodes and gynoecium. Drawn from the type.

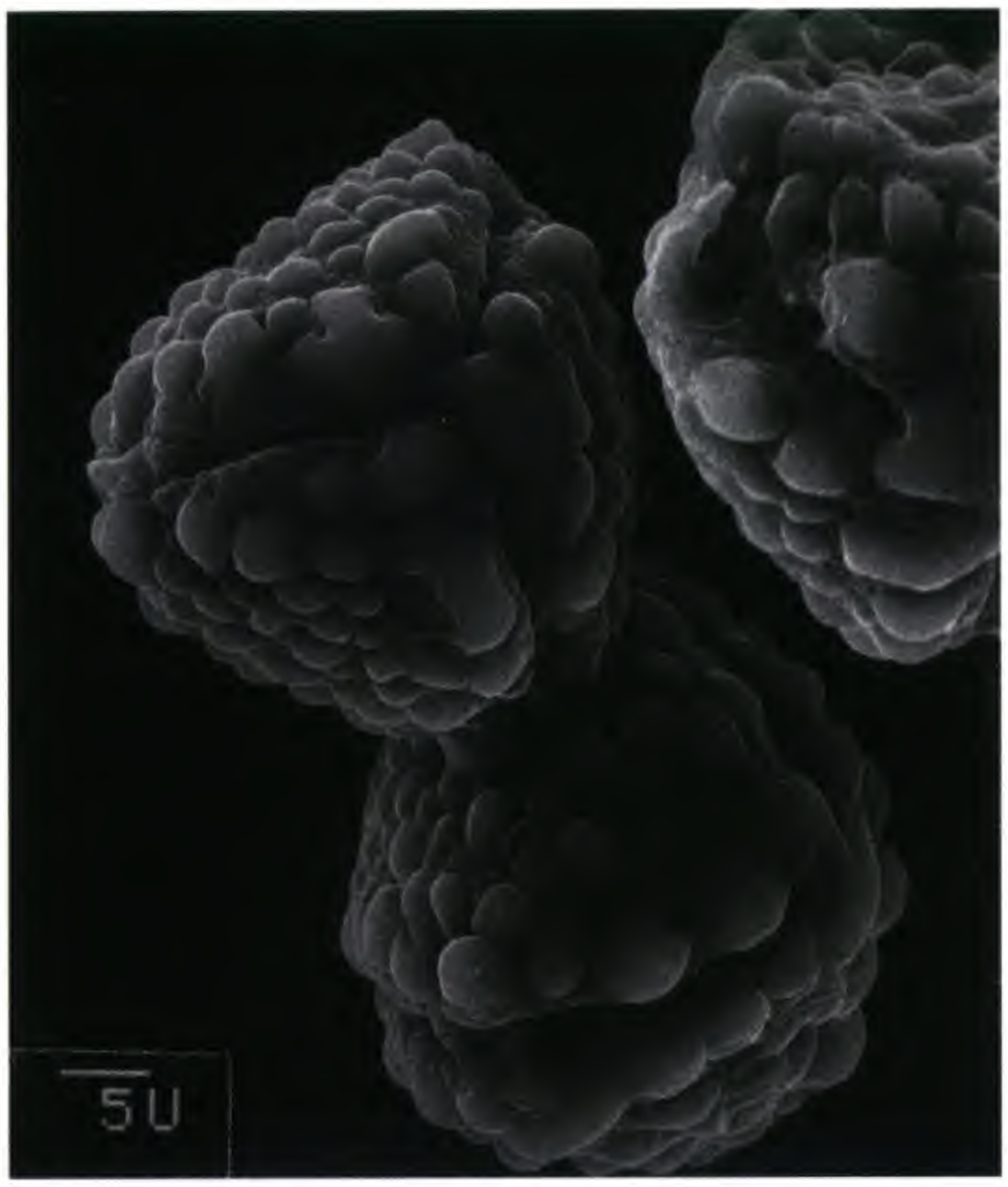


Figure 2. SEM image of pollen from the type of *Ecuadendron acosta-solisianum* showing tricolpate structure and coarsely verrucate surface ornamentation. Scale bar = 5 μm.

vated "sausage tree," which is a classic exemplar of chiropterophily (Faegri & van der Pijl, 1971). The coarsely verrucate pollen of *Ecuadendron* (Fig. 2) is simlar to that of several other bat-pollinated genera of Caesalpinioideae surveyed by Graham and Barker (1981), who suggested that such surface features of the pollen may be functional adaptations associated with bat-pollination. However, no nocturnal observations were made of *Ecuadendron* in flower, and visitations by bats have not been reported. A group of British students observed the hummingbird *Threnetes ruckeri* making repeated diurnal visits to the flowers of *Ecuadendron* at the Manglares-Churute population, but it was not clear that the hummingbirds were actually effecting pollination (Pople et al., 1997; Ian Burfield, pers. comm.). Flowers collected by the author at midday had no nectar and were odorless.

Relationships. This taxon clearly belongs in the tribe Detarieae DC. as circumscribed by Breteler (1995): the bracteoles are present and persistent after anthesis but do not cover the flower bud prior to anthesis, and the sepals are not reduced, such as occurs in the sister tribe Macrolobieae Breteler. Within the Detarieae, the relationships of *Ecuadendron* to other genera are not entirely clear. In Cowan and Polhill's (1981) key to genera of Detarieae, *Ecuadendron* would fall within the "*Brownea* group" by virtue of the fused bracteoles, and would key out next to *Brachycylix* (Harms) Cowan, with which it shares the 2-jugate leaflets, lack of bracts, cupular bracteolar structure, and 5 fertile stamens. *Brachycylix*, a monotypic genus with a restricted distribution in the Magdalena River valley of north-central Colombia, was originally described as a subgenus of *Heterostemon* Desfontaine. *Brachycylix* and *Ecuadendron* are both distinguished from *Heterostemon* by their petiolulate leaflets, pendent racemes, broad cupular fused bracteoles, and 5 rather than 3 fertile stamens. *Brachycylix*, however, has 3 petals while *Ecuadendron* has 5; moreover, the appearance of the androecium in the two genera is different. In *Brachycylix*, as well as in *Heterostemon*, the 9 staminal filaments are fused into a long inequilateral tube, open on one side; the central filaments are fused up to a higher point (about one-half their total length) than the outer filaments (cf. Cowan & Polhill, 1981: 129, fig. 4). In *Ecuadendron*, the staminal filaments form a much shorter, thicker, equilateral basal tube; the fertile filaments are of equal length and the alternating staminodes, much shorter and thinner than the fertile filaments, are also of equal length. In the structure of the androecium, with filaments fused basally into a short, thick ring, *Ecuadendron* more closely resembles *Elizabetha* Schomburgk ex Bentham than it does either *Brachcylix* or *Heterostemon*; *Elizabetha*, however, has only 3 fertile stamens, while *Ecuadendron* has 5, and differs from *Ecuadendron* also in the presence of well-developed bracts and a short non-pendent raceme.

The new taxon, in short, does not fit comfortably within any existing genus, but probably may best be grouped with *Brachycylix*, *Heterostemon*, and *Elizabetha*. In terms of geography, an interesting point is that *Heterostemon* and *Elizabetha* each contain several species and are essentially restricted to the Guayana Shield region, while *Brachycylix* and *Ecuadendron* are both monotypic, as far as known, and occur in restricted areas west of the Andes.

The twisted petilolules are a curious feature of *Ecuadendron*, which it shares with *Crudia* Schreber and some additional genera of Detarieae, but in *Ecuadendron* the petiolules are better described as plicate or "folded once and creased," while in *Crudia* they are merely twisted. The fruits and seeds of *Ecuadendron* bear a striking resemblance to those of *Brownea grandiceps* Jacquin and related species. This is not to suggest that the features shared between *Ecuadendron* and the latter two genera are synapomorphic, but rather to indicate the complex patterns of shared traits among the genera of Detarieae. A phylogenetic analysis of De-

tarieae, using molecular as well as morphological characters, would appear to be in order.

Paratypes. ECUADOR. **Azuay:** Cantón Cuenca, Manta Real, 350 m, 2°34′S, 79°21′W, 2 Mar. 1996 (fr), *David Neill, T. Núñez & A. Dik 10533* (collections from same tree as the type) (AAU, K, MO, NY, QCA, QCNE), 16 July 1991 (fl, fr), *Robin Foster 13587* (F, QCA), 23 Nov. 1992 (fl), *Karl Berg 102* (MO, QCNE), 29 Mar. 1993 (fr), *Karl Berg* 149 (MO, QCNE). **Esmeraldas:** Cantón Muisne, along Río Sucio between San Salvador community and Puerto Nuevo, 100–300 m, 0°30′N, 79°50′W, 1 Dec. 1995 (fl), *John Clark, Cyrus Brame & Manuel Marcia 1710* (MO, QCNE). **Guayas:** Cantón Naranjal, Reserva Ecológica Manglares-Churute, summit forest on Cerro Cimalón, 350 m, 2°26′S, 79°38′W, 9 Aug. 1996 (fl, fr), *D. Neill, T. Núñez & A. Dik 10648* (MO, QCNE).

Acknowledgments. Robin Foster and Karl Berg, on independent occasions, first collected the trees at Manta Real and alerted me to their existence. My colleagues in Ecuador—epecially Mercedes Asanza, John Clark, Alberto Dik, Tamara Núñez, and Homero Vargas—assisted with the field and herbarium work at QCNE. John Myers prepared the line drawings, and Mike Veith assisted with the SEM image. I thank Henk van der Werff, Roy Gereau, Rupert Barneby, and Roger Polhill for comments on earlier drafts of this paper. Botanical exploration in western Ecuador was supported by grants from the National Geographic Society and The Harry and Flora D. Freund Memorial Foundation.

Literature Cited

Breteler, F. J. 1995. The boundary between Amherstieae and Detarieae (Caesalpinioideae). Pp. 53–61 *in* M. D. Crisp & J. J. Doyle (editors), Advances in Legume Systematics, Part 7: Phylogeny. Royal Botanic Gardens, Kew.

Cowan, R. S. & R. M. Polhill. 1981. Detarieae. Pp. 117–134 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics, Part 1. Royal Botanic Gardens, Kew.

Dodson, C. H. & A. H. Gentry. 1991. Biological extinction in western Ecuador. Ann. Missouri Bot. Gard. 78: 273–295.

Faegri, K. & L. van der Pijl. 1971. The Principles of Pollination Ecology, 2nd ed. Pergamon Press, Oxford.

Graham, S. & G. Barker. 1981. Palynology and tribal classification in the Caesalpinioideae. Pp. 801–834 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics, Part 2. Royal Botanic Gardens, Kew.

Myers, N. 1988. Threatened biotas: "Hotspots" in tropical forests. Environmentalist 8: 1–20.

Neill, D. A. 1997. Ecuadorian Pacific coast mesic forests. Pp. 508–512 *in* S. D. Davis, V. H. Heywood, O. Herrera-MacBryde, J. Villa-Lobos & A. C. Hamilton (editors), Centres of Plant Diversity: A Guide and Strategy for their Conservation. Vol. 3: The Americas. IUCN Publications Unit, Cambridge, U.K.

Parker, T. A. & J. L. Carr. 1992. Status of forest remnants in the Cordillera de la Costa and adjacent area of southwestern Ecuador. RAP Working Papers 2: 1–172.

Pople, R. G., I. J. Burfield, R. P. Clay, D. R. Cope, C. P. Kennedy, B. López Lanús, J. Reyes, B. Warren & E. Yagual. 1997. Bird surveys and conservation status of three sites in western Ecuador: Final report of Project Ortalis. CSB Conservation Publications, Cambridge, U.K.

A New Species of *Ligusticum* L. (Apiaceae) from Yunnan Province, China

PENG Hua and WANG Yin-zheng

Kunming Institute of Botany, Chinese Academy of Sciences, Kunming, Yunnan 650204, China

ABSTRACT. A new species of the genus *Ligusticum* L., *L. pseudodaucoides* H. Peng & Yin Z. Wang, is described and illustrated. It was collected from the summit of the Wuliangshan Range in Jingdong County, south central Yunnan Province, China. Its affinity to *L. daucoides* is discussed, and habitat data are given.

The senior author has been conducting intensive fieldwork in the Wuliangshan Range since 1993. On the basis of this work and that by others, a checklist of the flora of Wuliangshan is being compiled following the systematic arrangement of Wu (1984). The checklist (Peng, unpublished) includes 2571 species in 1030 genera, and several novelties have been discovered. Among them is the species described herein.

Ligusticum consists of about 60 species, of which 22 have been reported from China (Chang, 1985). The new species occupies the southernmost geographical limits for the genus in China and grows on the peaks of Mt. Beiwawashan and Mt. Maotou; the latter is the highest point in the Wuliangshan Range.

Ligusticum pseudodaucoides H. Peng & Yin Z. Wang, sp. nov. TYPE: China. Yunnan: Jingdong Yi Nationality Autonomous County, heath on top of Mt. Maotou, Wuliangshan Range, 24°13′–11″N, 100°39′–46″E, 3306 m, 19 Nov. 1996, *H. Peng 2579* (holotype, KUN). Figure 1.

Herba perennis, 25–45 cm alta. Folia basalia et inferna longe petiolata, petiolis 8–12 cm longis, basi in vaginas dilatatis; laminis ambitu oblongo-ovatis, 5–15 cm longis, 3–5 cm latis, 3–4-pinnatis, 5–6-jugis, segmentis ultimis linearibus, 2–14 mm longis, 0.5–1 mm latis. Umbella composita 2–3 cm diam., umbella fructifera ad 6 cm diam.; involucri phylla 1–2, linearia, 1.5–2.5 cm longa, pubescentia, non persistentia post fructus maturitatem; radii 10–21, scabri inaequilongi, 1.5–4 cm longi; involucellorum phylla 6–10, 1–1.6 cm longa, in dimidio superiore trinacriformia vel lobis ultimis bifidis, cadentibus in statu fructificanti. Calycis dentes lineares, ca. 1.5 mm longi; petala oblonga, purpurea, apicibus anguste inflexa. Mericarpia suborbicularia, 5–6 mm longa, 4–4.5 mm lata, a dorso valde compressa, jugis dorsalibus leviter protrudentibus, jugis lateralibus in alas angustiores projectis, alis 0.5–0.8 mm latis; vittae ad valleculas dorsales 1, ad valleculas laterales 1, ad commissuram 4.

Perennial herbs, 25–45 cm tall. Root cylindric, up to 30 cm long, with the collar 5–10 cm long, 1 cm diam., densely covered with fibrous remains of leaf sheaths. Basal and lower cauline leaves with petioles 8–12 cm long, base dilated, sheathing; leaf blades oblong-ovate, 5–15 cm long, 3–5 cm wide, 3- or 4-pinnate, with 5 or 6 pairs, ultimate segments linear, 2–14 mm long, 0.5–1 mm wide; cauline leaves few, often with dilated sheathing petioles, blades gradually becoming simple. Umbels compound, 2–3 cm diam., up to 6 cm diam. in fruit; bracts 1–2, linear, 1.5–2.5 cm long, hairy, falling after fruit maturity; rays 10–21, scabrous, unequal in length, 1.5–4 cm long; bracteoles 6–10, 1–1.6 cm long, 3-lobed, trinacriform in the distal part or with a bifid terminal lobe. Calyx teeth 5, linear, ca. 1.5 mm long. Petals oblong, purplish, apex narrowly inflexed. Fruit elliptic or suborbicular, 5–6 mm long, 4–4.5 mm wide, strongly compressed dorsiventrally; dorsal ribs minutely protruding; lateral ribs more projected into narrow wings; lateral wings 0.5–0.8 mm wide. Vittae solitary in dorsal and lateral furrows, 4 on the commissure. Endosperm curved on commissure surface.

Ligusticum pseudodaucoides most closely resembles *L. daucoides* (Franchet) Franchet, a species that grows in northern Yunnan, southern Xizang (Tibet), and western Sichuan (Pu, 1993). However, it differs from the latter in often having trinacriform bracteoles, elliptic to suborbicular fruits 5–6 long mm and 4–4.5 mm wide, solitary vittae in the lateral furrow and 4 on the commissure, 5-toothed calyx, and oblong purplish petals. In contrast, *L. daucoides* has 1- or 2-pinnate bracteoles, oblong fruits 6–8 mm long and 3–4 mm wide, 1–3 vittae in each furrow and 4–6 on the commissure, 2- or 3-toothed calyx, and obovate white or abaxially purplish petals. The new species probably evolved from widely ranging geographically (eurychoric) related species in adaptation to high altitudes (3100 m or higher) and perhaps represents a vicariant element both in terms of geography and relationship.

The generic limits of *Ligusticum* vary according

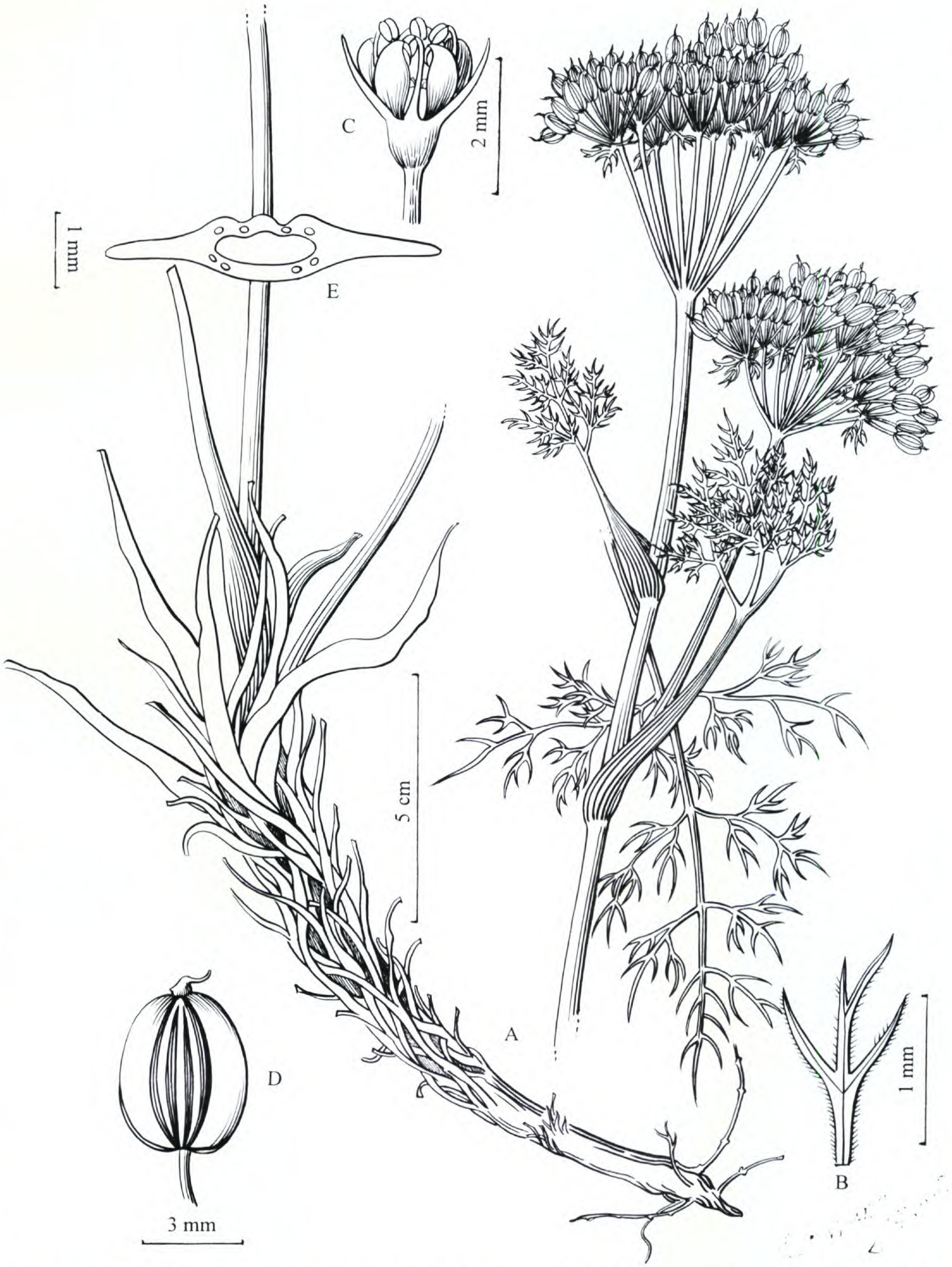


Figure 1. *Ligusticum pseudodaucoides* H. Peng & Y. Z. Wang. —A. Habit with detail of fruit. —B. Bracteole. —C. Flower. —D. Fruit. —E. Cross section of mericarp showing the oil canals and endosperm.

to the authors. Of the 22 species recognized by Chang (1985), seven were treated as *Ligusticopsis* by Leute (1969), who retained *L. daucoides* in *Ligusticum*. In our opinion, *L. pseudodaucoides* is a perfectly good member of the genus regardless of how it is circumscribed.

Ligusticum pseudodaucoides is highly restricted to Jingdong County, an area where the Yi people form the majority of the population. The Yi people use the roots of this species in making chicken stew, which postpartum women drink as a tonic to build up health. They call it "tu san qi," which means "local Panax noto-ginseng."

Ligusticum pseudodaucoides grows in heath communities at 3100 m and higher. Such areas are under snow cover for three months and are considered subalpine. They are dominated by *Rhododendron siderophyllum* Franchet, *Vaccinium delavayi* Franchet, *V. chamaebuxus* C. Y. Wu, *Gaultheria forrestii* Diels, *G. cardiosepala* Handel-Mazzetti, and *Enkianthus deflexus* (Griffith) Schneider. This new species appears to be a sparse element of such scrub habitats dominated by members of the Ericaceae and previously studied at some depth (Anonymous, 1960).

Paratype. CHINA. **Yunnan:** Jingdong, Yi Nationality Autonomous County, heath on the top of Mt. Beiwawashan, near Mt. Maotou, 3150 m, 10 Nov. 1993, *H. Peng 2206* (KUN).

Acknowledgments. We are grateful to Wu Zheng-yi for his guidance and for his critical review of the manuscript. We thank Hu Yang and Ihsan Al-Shehbaz for correcting the English, L. Wang for drawing the figure, Zhang Xing-wei, the director of the Department of Natural Reserve of the Wuliangshan Range, for supporting the expedition to Mt. Maotou, and Wang Qiang, Xiao De-bing, and Yuan De-cai for helping in the field work. This article is the result of part of a major project on the biodiversity in the Yunnan Mekong River Basin, supported financially by Academia Sinica.

Literature Cited

Anonymous. 1960. The vegetation of Ching-Tung, Wu-Liang Shan Nature Conservation Station. A survey of plant communities of the Nature Conservation Station in the Tropical and Subtropical Regions of Yunnan Province, China. J. Yunnan Univ. (Nat. Sci.) 1960(1): 97–154.

Chang, H. T. 1985. *Ligusticum*. *In*: Shan Ren-hwa & Sheh Meng-lan (editors), Fl. Reipubl. Popularis Sin. 55(2): 234–257.

Leute, G. H. 1969. Untersuchungen ueber den Verwandtschaftskreis der Gattung *Ligusticum* L. (Umbelliferae): I Teil. Ann. Naturhist. Mus. Wien 73: 55–98.

Pu, F. T. 1993. Umbelliferae. Pp. 1276–1355 *in* W. T. Wang (editor), Vascular Plants of the Hengduan Mountains. Science Press, Beijing.

Wu, C. Y. 1984. Index Florae Yunnanensis. Vols. 1 and 2. The People's Publishing House, Yunnan.

Bromus catharticus in South America (Poaceae: Bromeae)

Paul M. Peterson
Department of Botany NHB-166, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

Ana María Planchuelo
CONICET: Facultad de Ciencias Agropecuarias, Universidad Nacional Córdoba, Casilla de Correo 509, 5000 Córdoba, Argentina

ABSTRACT. A new combination, *Bromus catharticus* var. *rupestris*, is made. Based on morphological evidence this taxon seems best recognized at the varietal level. Detailed illustrations of *B. catharticus* var. *rupestris* and *B. catharticus* var. *catharticus* are included along with morphological descriptions, distributions, and representative specimens.

RESUMEN. Se realiza una nueva combinación, *Bromus catharticus* var. *rupestris*. Sobre la base de las evidencias morfológicas, parece mejor reconocer este taxon a nivel de variedad. Se incluyen ilustraciones detalladas de *B. catharticus* var. *rupestris* y *B. catharticus* var. *catharticus* junto con descripciones morfológicas, distribuciones y especímenes representativos.

Bromus L. comprises approximately 150 species found mainly in the temperate regions of both hemispheres (Clayton & Renvoize, 1986). The genus has been divided into five to seven groups (Stebbins, 1981; Tsvelev, 1976), depending upon the recognition of *Anisantha* C. Koch, *Boissiera* Steudel, *Bromopsis* Fourreau, *Ceratochloa* P. Beauvois, and *Nevskiella* Krecz & Vvedensky as separate genera. In a recent treatment of *Bromus* in the United States and Canada, Pavlick (1995) recognized five sections: *Bromopsis*, *Bromus*, *Ceratochloa*, *Genea*, and *Neobromus*.

In North and South America, *Bromus* sect. *Ceratochloa* consists of approximately 18 species of which *B. catharticus* Vahl is a member (Matthei, 1986; Nicora, 1978; Pavlick, 1995; Pillay & Hilu, 1995; Soderstrom & Beaman, 1968; Tovar, 1993; Zuloaga et al., 1994). This section is entirely native to the New World and contains an extensive polyploid complex, base of $x = 7$. All taxa thus far examined are either hexaploid ($2n = 42$), octoploid ($2n = 56$), or duodecaploid ($2n = 84$) (Armstrong, 1991; Pavlick, 1995; Stebbins, 1956, 1981; Stebbins & Tobgy, 1944). *Bromus catharticus* and immediate relatives are all hexaploid (Naranjo, 1992).

The *Bromus catharticus* complex presently contains six taxa (Planchuelo, 1991; this paper): *B. bonariensis* Parodi & J. A. Camara, *B. brevis* Nees ex Steudel subsp. *brevis*, *B. brevis* subsp. *festucarioides* Covas & Millot, *B. catharticus*, *B. parodii* Covas & Itria, and *B. striatus* Hitchcock [= *B. catharticus* var. *striatus* (Hitchcock) Pinto]. We choose to recognize *B. catharticus*, as proposed by Pinto-Escobar (1976), as the true name for rescue grass, rather than that proposed earlier by Raven (1960) as *B. willdenowii* Kunth. The Andean species, *B. unioloides* Kunth, and *B. willdenowii* are treated here as taxonomic synoyms of the older, *B. catharticus*.

Studies of the *Bromus catharticus* complex (excluding *B. striatus*) indicate that the crossability among four species (*B. bonariensis*, *B. brevis*, *B. catharticus*, *B. parodii*) is low (Naranjo, 1992). In recent years the use of hybridization studies in systematics has declined since exceptions to the correlation between pairing and genome homology have been found (Seberg, 1989; Doyle et al., 1990a, 1990b). Several authors (Ragonese & Marco, 1941, 1943; Pérez López, 1975; Cladera, 1979; Pahlen et al., 1980; Wolff et al., 1996) described the morphological features of *B. catharticus* under varying environmental conditions. More recently, Abbott et al. (1996), Aulícino and Arguri (1996), and Gutierrez et al. (1996) pointed out phenotypic variation in the vegetative features of *B. catharticus*. The polymorphic nature of *B. catharticus* has led to the description of numerous taxa at the specific and varietal levels, and we offer our treatment here. Prior results (Planchuelo, 1991) of a phenetic analysis of 16 morphological characters suggest that *B. bonariensis*, *B. brevis*, and *B. catharticus* be considered conspecific.

At the present time we choose to recognize *B. bonariensis*, an endemic of Provincia Buenos Aires, Argentina, as a separate species since there appears to be no overlap with other taxa in the com-

plex in the length of the lemmatal awns (5–9 mm). We recognize *B. striatus*, an endemic of Peru, as a separate species, as opposed to a variety (Pinto-Escobar, 1986), since there is no overlap in the length of the lemmatal awns (12–18(–25) mm). The status of *B. bonariensis* and *B. striatus* is currently being investigated for DNA markers by the authors.

In this study, a comparison of morphology among members of the *Bromus catharticus* complex has been made, and the recognition of *B. brevis* at the varietal level seems warranted. In this rank variety *rupestris*, based on *B. unioloides* var. *rupestris* Spegazzini, a taxonomic synonym, has priority. We include descriptions, synonymy, representative specimens, a key to the varieties, and an illustration of *B. catharticus* var. *rupestris* (Spegazzini) Planchuelo & P. M. Peterson and variety *catharticus*.

KEY TO THE VARIETIES OF *BROMUS CATHARTICUS*

1a. Lemmas mucronate or with a short awn 0.3–0.5(–1) mm long; young blades predominantly folded . . . . . *B. catharticus* var. *rupestris*

1b. Lemmas with an awn 0.5–4(–5) mm long; young blades predominantly convolute . . . . . *B. catharticus* var. *catharticus*

Bromus catharticus Vahl var. **rupestris** (Spegazzini) Planchuelo & P. M. Peterson, comb. nov. Basionym: *Bromus unioloides* Kunth var. *rupestris* Spegazzini, Contr. Fl. Sierra Vent. 76: 1896. TYPE: Argentina. Prov. Buenos Aires: Sierra Ventana, *Spegazzini 12624* (lectotype, here designated: specimen was marked as "Typus de *Bromus unioloides* var. *rupestris* Spegazzini," LP!). Figure 1.

Bromus brevis Nees ex Steudel, Syn. Pl. Glumac. 1: 326. 1854. *Ceratochloa brevis* Nees ex Jackson, Index Kew. 1: 487. 1895. *Bromus unioloides* Kunth var. *brevis* (Nees ex Steudel) Hackel, Anales Mus. Nac. Hist. Nat. Buenos Aires 11: 144. 1904. *Bromus unioloides* Kunth f. *brevis* (Nees ex Steudel) Kloos, Ned. Kruidk. Arch. 1917.175. 1918. TYPE: Argentina. Mendoza, *Gillies s.n.* (isotype, K, fragment, US!).

Bromus brevis Nees ex Steudel subsp. *festucarioides* Covas & Millot, Apuntes Fl. Pampa 62: 247. 1981. TYPE: Argentina. Prov. La Pampa: Departamento Caleu, La Adela, *G.Covas 2163* (isotype, CORD!).

Plants annual or biennial. Culms (5)30–60(70) cm tall. Ligules 2–3 mm long. Sheaths pubescent, the hairs up to 2 mm long. Blades 2.5–5 mm wide, flat or folded (young blades predominantly folded), pubescent. Panicles (4)10–15 cm long, erect, semicontracted inflorescence with 2–45 spikelets; pedicels 3–25 mm long, rigid. Spikelets (10)13–20(25) mm long, 5–10-flowered, imbricate, commonly compressed laterally, occasionally with little compression, then the spikelets fusiform. Glumes broadly ovate; the lower 5–11 mm long, 1.6–3 mm wide, 5–7-nerved; the upper 6–12 mm long, 9–11-nerved. Lemmas 7–15 mm long, 2–4 mm wide, 9–11-nerved, ovate, glabrous to pubescent; the marginal nerves bifurcating from the base of the second nerve from the keel; apex acute or cuspidate, the awn 0.3–0.5(1) mm long. Paleas 5–9 mm long, strongly keeled and adherent to the caryopsis. Anthers 0.4–0.7 mm long. Caryopsis with a deep, narrow furrow.

Distribution. Known from central and southwest Argentina from Provincias Buenos Aires and Córdoba in the north, south to Santa Cruz, where it occurs on sandy river banks and slopes from elevations of near sea level to 2600 m. This endemic variety appears to be good forage for cows (Ragonese, 1967) and is infrequently found in open pampas/puna habitats and margins of forests. The common name for this species is "Cebadilla pampeana."

Representative specimens. ARGENTINA. **Buenos Aires:** Campana, 1 Nov. 1936, *L. Parodi 12244* (BAA, US); Partido de Junín, 21 Dec. 1928, *E. C. Clos 3976* (US); Estancia "Des Chanaves," *E. Gibson s.n.* (US); Depto. Necochea, Punta Negra, 12 Dec. 1938, *W. J. Eyerdam, A. A. Beetle & E. Grondona 23729* (US); Depto. Villarino, 60 km E of Rio Colorado, 16 Dec. 1938, *W. J. Eyerdam, A. A. Beetle & E. Grondona 23744* (US). **Chubut:** Depto. Rawson, 2 km S of Trelew on S bank of the Chubut River, 22 Dec. 1938, *W. J. Eyerdam, A. A. Beetle & E. Grondona 23582* (US). **Córdoba:** Tupungato, Estancia La Carrera, 27 Dec. 1949, *O. Melis & O. Paci 44* (US); Depto. General Roca, cauce seco del Río Quinto, en los alrededores del cruce con la Ruta Nacional 35, entre Huinca Renancó y Vicuña Mackenna, 3 Nov. 1971, *A. T. Hunziker & D. Fulvio 21451* (CORD); Depto. Ischilín, Dean Funes, 20 Dec. 1946, *M. Villafañe 129* (US); Depto. Roque Saenz Peña, Cerca de Pacheco de Melo, yendo a Laboulaye, 1 Nov. 1956, *A. T. Hunziker 12772* (CORD); Deptos. Tercero Arriba/San Martín, Estancia Patria, entre Luca y Dalmacio Vélez Sársfield, 18 Jan. 1956, *A. T. Hunziker 11566* (CORD); Depto. Río Segundo, Colonia Ruiz, pedanía Matorrales, cerca de Villa del Rosario, 12 Nov. 1902, *Stuckert 12045* (CORD). **La Pampa:** Gral. Acha, 29 Nov. 1959, *N. S. Troncoso 20495* (SI, US). **Mendoza:** Depto. Las Heras, Cuesta de Las Minas, 18/22 Jan. 1897, *Kurtz 9369* (CORD); Puenta del Inca, 3 Jan. 1950, *O. Paci 161* (US); Depto. Luján, Ugarteche, 19 Nov. 1955, *F. A. Roig 7396* (CORD, MERL, US); Las Aguaditas, 18 Dec. 1985, *Dalmasso 429* (MERL); Depto. Malargüe, Coihueco norte, 15 Nov. 1959, *F. A. Roig 3446* (CORD, MERL, US); Los Molles inmediaciones del hotel Lahuen-co, 20 Dec. 1981, *Del Vitto s.n.* (MERL); Depto. Maipú, Médanos de los Morritos (El Tapon), 27 Nov. 1949, *A. R. Leal & O. Paci 487* (US); Depto. San Carlos, Entre Yagualito y Las Peñas, 5 Dec. 1887, *Kurtz 5409* (CORD); Depto. San Rafael, Entre Santa María y Fortín Nuevo, 12/13 Jan. 1892, *Kurtz 7042* (CORD); Cuadro Benegas entre Ruta Nac. 144 y Rio Atuel, 12 Nov. 1981, *Del Vitto s.n.* (MERL); Cercania del embalse Agua del Toro, 22 Nov. 1996, *A. M. Planchuelo*

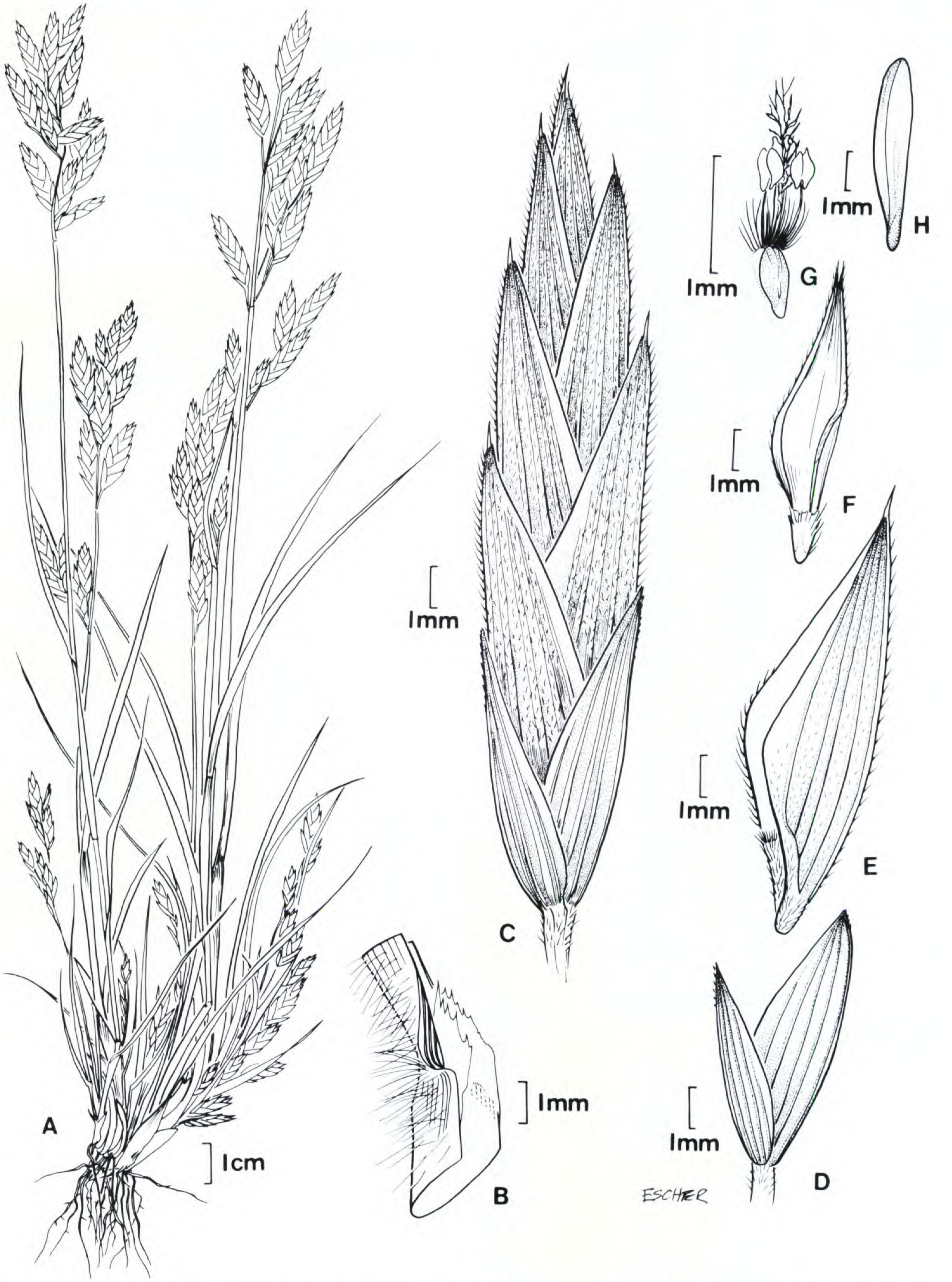


Figure 1. *Bromus catharticus* Vahl var. *rupestris* (Spegazzini) Planchuelo & P. M. Peterson. —A. Habit. —B. Ligule. —C. Spikelet. —D. Glumes. —E. Lemma. —F. Palea. —G. Gynoecium and androecium. —H. Caryopsis. Based on *Fischer 51* (US).

1068 (ACOR); Depto. Tupungato, Rodeo Seguro, 12 Nov. 1953, *F. A. 139* (CORD, MERL, US). **Neuquén:** Pino Hachado, Feb. 1920, *L. R. Parodi 3159* (BAA, US); Sierra Auca Mahuda, Nov. 1953, *H. A. Fabris 802* (US); Depto. Chos Mala, Entre Chosmalal y Chorriaca, orillas del Río Pichi-Neuquén, 16 Nov. 1969, *F. A. Roig 6300* (CORD, MERL, US); Depto. Picunches, Las Lajas, 18 Nov. 1969, *F. A. Roig 6247* (CORD, MERL, US). **Santa Cruz:** Puerto Santa Cruz, 22 Dec. 1895, *P. Duseù s.n.* (US); Depto. Deseado, Puerto Deseado, 29 Dec. 1938, *W. J. Eyerdam, A. A. Beetle & E. Grondona 23870* (US); Depto. Guar Aiken, Rio Gallegos, 3 Jan. 1939, *W. J. Eyerdam, A. A. Beetle & E. Grondona 24072* (US). **San Juan:** Depto. Iglesias, Sierra de Colangüil, 1887/1888, *Kurtz 5354* (CORD). **Rio Negro:** Los Juncos, 27 Feb. 1934, *L. R. Parodi 11372* (BAA, US). **San Luis:** Alrededores de San Luis, 5 Nov. 1960, *G. Covas 1085* (US); General Roca and vicinity, 21 Jan. 1915, *W. Fischer 51* (US); Depto. General Pedernera, Ruta 148 entre Lavaisse y El Durazno, 23 Nov. 1962, *A. T. Hunziker & A. Cocucci 15978* (CORD); al borde de medano al norte de Laguna Sayape, 7 Nov. 1969, *D. Anderson 1613* (CORD); Depto. Pringles, Cerca de Fraga a unos 40 dm de Villa Mercedes, Ruta 7, 14 Nov. 1956, *A. T. Hunziker 13139* (CORD). **Tucumán:** Villa Nougues, 4 Nov. 1930, *G. L. Fawcett s.n.* (US).

Although the venation characteristic of the lemma appears to be useful in separating *B. catharticus* var. *rupestris* from variety *catharticus* it is often (usually) very difficult to see even under 20× magnification. Other specimens, such as *Kurtz 10034* (CORD) from Puesto Lima, Mendoza, have a few spikelets with additional bracts below the glumes that are 1–3-nerved. Another specimen (*Kurtz 5668*, CORD), from the Rio Atuel, Mendoza, has a few spikelets with an additional 5-nerved bract at the base. Besides these few aberrant characteristics, all other characteristics seem to be consistent with those described for this variety.

Bromus catharticus Vahl, Symb. Bot. 2: 22. 1791. var. **catharticus**. *Ceratochloa cathartica* (Vahl) Herter, Rev. Sudamer. Bot. 6: 144. 1940. TYPE: Peru. Lima: *J. Dombey s.n.* (lectotype, selected by Pinto-Escobar (1976) P-JU, microfiche, US!; isolectotype, P). Figure 2.

Festuca unioloides Willdenow, Hort. Berol. 1: 3. pl. 3. 1803. *Ceratochloa unioloides* (Willdenow) P. Beauvois, Ess. Agrostogr. 75, t. 15, f. 7. 1812. *Bromus unioloides* (Willdenow) Raspail, Ann. Sci. Nat. Bot. 5: 439. 1825, hom. illeg., not Kunth 1816. *Bromus willdenowii* Kunth, Revis. Gramin. 1: 134. 1829. *Tragus unioloides* (Willdenow) Panz ex B. D. Jackson, Ind. Kew. 2: 1099. 1895. TYPE: (holotype, grown at Berlin from seed from Carolinas, USA, B-W, microfiche, US!).

Bromus unioloides Kunth, Nov. Gen. Sp. 1: 151. 1816. *Schedonorus unioloides* (Kunth) Roemer & Schultes, Syst. Veg. 2: 709. 1817. *Zerna unioloides* (Kunth) Lindman, Sv. Fanerogamfl. 101. 1918. TYPE: Ecuador. Pichincha: *Humboldt & Bonpland 2286* (holotype, P!, fragment, US!; isotype, P).

Bromus strictus Brongniart, in Duperrey, Voy. Monde 2: 45. 1829. TYPE: Brazil. Santa Catarina: 1825, *D'Urville s.n.* (holotype, P, fragment, US!, fragment & photo, BAA!).

Ceratochloa haenkeana J. S. Presl, Reliq. Haenk. 1: 285. 1830. *Bromus haenkeanus* (J. S. Presl) Kunth, Enum. Pl. 1: 416. 1833. *Bromus unioloides* var. *haenkeanus* (J. S. Presl) Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 52. 1900. TYPE: Chile. *T. Haenke s.n.* (holotype, PR, fragment, US!).

Ceratochloa secunda J. S. Presl, Reliq. Haenk. 1: 285. 1830. *Bromus preslii* Kunth, Enum. Pl. 1: 416, 545. 1833. TYPE: Peru. *T. Haenke s.n.* (holotype, PR, fragment, US!).

Ceratochloa breviaristata Hooker, F. Bor. Amer. 2: 253. 1840. *Bromus breviaristatus* (Hooker) Thurber, U. S. Expl. Exped. Bot. 17: 493. 1874, not Buckley, 1862. *Forasaccus breviaristatus* (Hooker) Lunell, Amer. Midl. Naturalist 4: 225. 1915. TYPE: Lewis and Clarks River and near sources of the Columbia, 1826, *Douglas s.n.* (holotype, K, fragment, US!).

Bromus unioloides Kunth var. *sanjuaninus* Hieronymus, Bol. Acad. Nac. Ci. 4: 69. 1881. TYPE: Argentina. Prov. San Juan, *Echegaray s.n.* (isotypes, BAA!, CORD!).

Bromus angustatus Pilger, Bot. Jahrb. Syst. 25: 719. 1898. TYPE: Bolivia. La Paz, *Steubel 60c* (holotype fragment US!).

Bromus unioloides Kunth var. *montanus* Hackel ex Stuckert, Anales Mus. Nac. Buenos Aires 11: 144. 1904. Syn. nov. TYPE: Argentina. Prov. Córdoba: Cueva del Arroyo de los Tabaquillos, Sierra de Achala, *Stuckert 10855* (holotype fragment US!; isotype, CORD!).

Bromus unioloides Kunth f. *chasmogama* Hackel, Anales Mus. Nac. Hist. Nat. Buenos Aires 13: 527. 1906. TYPE: Argentina. Prov. Córdoba: Altos Sud de Córdoba, *Stuckert 3448a* (isotype, CORD!).

Bromus unioloides Kunth f. *chasmogama* Hackel subf. *achalensis* Hackel & Stuckert, Anales Mus. Nac. Hist. Nat. Buenos Aires 21: 172. 1911. Syn. nov. TYPE: Argentina. Prov. Córdoba: Estancia Pampa de San Luis, Achala, *Stuckert 20651* (isotype, CORD!).

Caespitose annual, biennial, occasionally perennial. Culms (5)20–100(120) cm tall. Ligules 2–5 mm long. Sheaths glabrous or sparingly pubescent. Blades 2–9 mm wide, usually flat (young blades predominantly convolute), glabrous or sparingly pubescent. Panicles (2.5)10–20(30) cm long, 5–9-flowered, erect or lax, semi-contracted; primary inflorescence with 4–58 spikelets; lateral branches sometimes nodding at maturity; pedicels 8–35 mm long. Spikelets (7)15–30(40) mm long, 4–11-flowered, very imbricate and compressed laterally, occasionally with little compression, then the spikelets fusiform, often purplish. Glumes ovate, glabrous; the lower 6–12 mm long, 1.6–4 mm wide, 3–7-nerved; the upper 8–14 mm long, 2.2–5 mm wide, (5)7–9-nerved. Lemmas 10–17 mm long, 3–

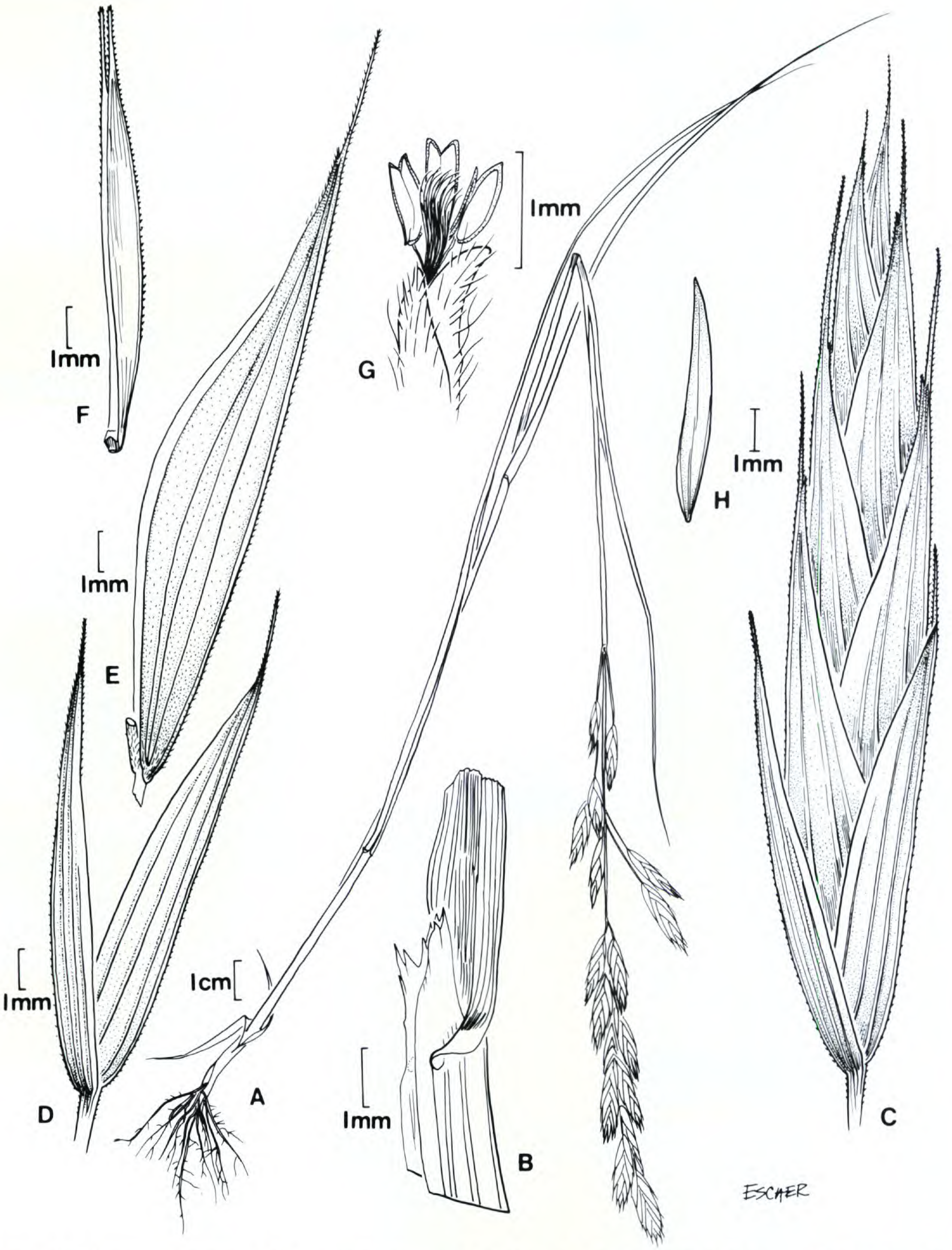


Figure 2. *Bromus catharticus* Vahl var. *catharticus*. —A. Habit. —B. Ligule. —C. Spikelet. —D. Glumes. —E. Lemma. —F. Palea. —G. Gynoecium and androecium. —H. Caryopsis. Based on *Peterson, Annable, Lægaard, Soreng & Rojas-Ponce 12824* (AAU, BH, K, LPB, US).

6 mm wide, 7–11-nerved, ovate, glabrous or occasionally minutely pubescent; the marginal nerves originating independently from the base of the second nerve from the keel; apex acute, aristate, the awn 0.5–4(5) mm long. Paleas 8–14 mm long, strongly keeled and adherent to the caryopsis. Anthers 0.5–1.3 mm long. Caryopsis with a deep, narrow furrow.

Distribution. A widespread taxon ranging from North America, Central America, to South America, where it is native. In Argentina, *Bromus catharticus* var. *catharticus* is more common north of the 38th parallel. An excellent forage grass in natural pastures in temperate, subhumid, and humid zones.

Representative specimens. ARGENTINA. **Buenos Aires:** Distrito Federal, Palermo, 21 Jan. 1941, *J. J. Rossi 60* (KIL); Part. Tandil, Tandil, 2 Dec. 1948, *Meyer 14408* (LIL). **Catamarca:** Depto. Ambato, Cumbres de Narváez (Falda O), Ruta 62 km. 1436/1435 entre el cruce con Ruta 65 y Las Chacritas, rumbo a Singuil., 10 Dec. 1965, *A. T. Hunziker, Cocucci & Subils 18535* (CORD); Depto. El Alto, Sierra de Ancasti, Ruta 64, entre el desvío a Frías y Los Morteros, 2 Dec. 1960, *A. T. Hunziker & Cocucci 15656* (CORD); Depto. Pomán, Sierra de Ambato (Falda W), Mutquin, entre Colana y Rincón, 8 Dec. 1965, *A. T. Hunziker, Cocucci & Subils 18432* (CORD); Depto. Santa Maria, Cerrillos, 16 Dec. 1933, *Peiraus s.n.* (US). **Chaco:** Depto. Primero de Mayo, Colonia Margarita Belén, 30 Jan. 1907, *T. Stuckert 19187* (CORD). **Córdoba:** Depto. Calamuchita, Valle de Los Reartes, 30 Dec. 1919, *Castellanos s.n.* (LIL); Deptos. Calamuchita/San Javier, Cerro Campaquí, 16 Dec. 1885, *Kurtz 2976* (CORD); Depto. Capital, Ciudad Universitaria, 10 Dec. 1990, *A. M. Planchuelo 546* (ACOR); Depto. San Alberto, entre cuesta del corral de Ceballos y Circo del Champaquí, 15 Dec. 1885, *Kurtz 2967* (CORD); Depto. San Martín, entre Luca y Dalmacio Velez, 18 Jan. 1956, *A. T. Hunziker 11564* (CORD); Depto. Santa María, Alta Gracia, 9 Jan. 1940, *A. T. Hunziker 506* (CORD); entre La Serranita y Villa Ciudad de America, Estancia La Praviana, 16 Nov. 1996, *A. M. Planchuelo 1062* (ACOR); Depto. Union, Ballesteros, Estancia Atahiva, 12 Oct. 1990, *A. M. Planchuelo 545* (ACOR). **Corrientes:** Depto. Empedrado, Estancia La Yela, 20 Oct. 1965, *T. M. Pederson 7473* (US). **Entre Rios:** Depto. Concordia, Estacion Experimental INTA, 22 Dec. 1992, *A. M. Planchuelo 593* (ACOR). **Jujuy:** Depto. Cochinoca, Laguna Tres Cruces, 14 Feb. 1901, *Kurtz 11672* (CORD); Depto. Santa Catalina, 9 Jan. 1901, *Kurtz 11415* (CORD). **La Rioja:** Depto. Capital, cerca de la mina El Cantadero (La Esperanza), 5/6 Mar. 1944, *A. T. Hunziker 5192* (CORD); Depto. Famatina, Sierra de Famatina, La Mesada, 20 Mar. 1906, *Kurtz 13845* (CORD). **Salta:** Depto. Guachipas, Alemania, 15 Dec. 1929, *S. Venturi 9954* (US); Depto. San Antonio de Los Cobres, Quebrada Urcuru, 12 Feb. 1945, *A. L. Cabrera 8678* (US). **San Juan:** Calingasta o Cordillera del Espinacito, Los Manantiales, 6 Feb. 1897, *Kurtz 9594* (CORD); Depto. Rivadavia, Margnesado, 27 Nov. 1945, *A. R. Cuezzo 1502* (US). **San Luis:** Depto. San Martín, Sierra de San Luis, San Martín, en La Pileta, *A. T. Hunziker & Cocucci 14586* (CORD). **Santa Fe:** Depto. Cayasta, en quinta abandonada al lado de la Ruta, 16 Oct. 1996, *A. M. Planchuelo 1019* (ACOR); Depto. La Capital, Isla Timbo, 17 Oct. 1996, *A. M. Planchuelo 1035 & 1061* (ACOR). **Tucumán:** Depto. Tafí, Cumbre de Malamala, *M. Lillo 3510* (LIL). BOLIVIA. **Cochabamba:** Quillacollo, Camino Sipe–Lipichi, 22 Mar. 1990, *I. Hanson 651* (US). **La Paz:** La Florida, 21 Dec. 1923, *A. S. Hitchcock 22611* (US); Lake Titicaca, Omasuyas, 22 Feb. 1987, *S. A. Renvoize 4577* (US); Prov. Ingavi, Titicani-Tacaca, 11 May 1989, *X. Villavicencia 1008* (US); Prov. Larecaja, Sorata, 1886, *H. H. Rusby 225* (US); Prov. Aroma, Huaraco, 10 Jan. 1981, M. *Liberman 274* (US); Prov. Loayza, 12.1 mi. NW of Villa Loza, 4 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard & R. J. Soreng 12647* (US); Prov. Nor Yungas, Unduavi, 3 Apr. 1981, *S. A. Renvoize & T. A. Cope 4178* (US). **Oruro:** Prov. Cerado, 14 mi. S of Oruro, 6 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard & R. J. Soreng 12697* (US); Prov. Poopa, 4.5 mi. N of Pazna, 6 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard & R. J. Soreng 12719* (US); Prov. S. Pagador, 5 mi. S of Challapata, 7 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard & R. J. Soreng 12734* (US). **Potosi:** Altiplano Cerca de Tupiza, Feb. 1948, *A. Bridorolli 4307* (US); Prov. Quijarro, 4 mi. SW of Vilacota, 28 Mar. 1993, *P. M. Peterson, R. J. Soreng & S. Lægaard 13127* (US); Sud Chichas, 9 Jan. 1924, *A. S. Hitchcock 22877* (US); 58 mi. SE of Uyuni, 13 Mar. 1993, *P. M. Peterson, C. R. Annable, S. Lægaard, R. J. Soreng & F. Rojas-Ponce 12852* (US). BRAZIL. **Santa Catarina:** Caxambu, 29 Oct. 1963, *R. M. Klein s.n.* (US); Caxias do Sul, 13 Nov. 1986, *G. G. Grazziotin 1930* (US); San Benito do Sul, 26 Nov. 1972, *R. M. Klein s.n.* (US); Mun. Blumenau, Spitzkopf, 20 Mar. 1952, *L. B. Smith & P. R. Reitz 6275* (US); Mun. Uruguai, Vila Rica, 24 Oct. 1964, *L. B. Smith & P. R. Reitz 12919* (US). **Paraná:** Curitiba, 2 Oct. 1966, *Lindeman 2666* (US). **Rio Grande do Sul:** Irai, 8 Jan. 1947, *E. Raupp 142* (US); Porto Alegre, 5 Nov. 1936, *W. A. Archer 4330* (US); Mun. Rio Pardo, Fasenda Soledade, Oct. 1922, *C. Jurgens s.n.* (US); Mun. Vacaria, 14 km de Vacaria rumo Bom Jesus, 25 Oct. 1961, *G. F. J. Pabst 6334* (US). **São Paulo:** 10 km S of São Paulo, 20 Oct. 1966, *T. Sendulsky 381* (US). CHILE. **Antofagasta:** Irrigated park, Ciudad Antofagasta, 24 Jan. 1924, *A. S. Hitchcock 22935* (US); near Calama, 4 Nov. 1914, *J. N. Rose 19432* (US). **Concepción:** Concepción, Jardín Zoológico, 4 Feb. 1958, *E. Junge 3092* (US). **Coquimbo:** Coquimba La Laguna, 3 Jan. 1945, *E. Barros 5427* (US). **Santiago:** Los Cerrillos, 12 Oct. 1941, *H. Gunckel 12525* (US); Puente Alto near Santiago, 3 Oct. 1919, *E. W. D. Wilson & M. M. Wilson 83a* (US); Cerro San Cristobal, 5 Sep. 1950, *H. Gunckel 18708* (US); San Jose de Maipo, 5 Oct. 1919, *E. W. D. Wilson & M. M. Wilson 88* (US). COLOMBIA. **Antioquia:** Santa Elena, 28 Dec. 1930, *W. A. Archer 1199* (US). **Cauca:** Macizo Colombiano, 7–27 Sep. 1958, *Idrobo, Pinto & Bischler 3410* (US). **Cundinamarca:** Bogotá, May 1916, *Apollinaire & Arthur 26* (US). **Narino:** Tuquerres, May 1853, *J. Triana 901* (US). **Norte de Santander:** Pamplona, 23 Mar. 1935, *W. A. Archer 3231* (US). ECUADOR. **Azuay:** Parque Nacional Cajas, 21 Apr. 1990, *P. M. Peterson, C. R. Annable & M. Poston 8867* (US). **Bolívar:** 6.4 km E of Guaranda, 23 May 1990, *P. M. Peterson, E. J. Judziewicz, R. M. King & P. M. Jørgensen 9271* (US). **Cañar:** Near El Tambo, 4 May 1945, *W. H. Camp 2922* (US). **Carchi:** 5 mi. S of Tulcan, 10 Aug. 1923, *A. S. Hitchcock 20974* (US). **Chimborazo–Cotopaxi:** 20 km N of Ambato, 16 Apr. 1990, *P. M. Peterson, C. R. Annable & M. Poston 8783* (US). **Imbabura:** Pimampiro, 21 Nov. 1949, *M. Acosta-Solis 14539* (US). **Imbabura–Pinchincha:** Entre Proantag y Pesillo,

7 Apr. 1952, *M. Acosta-Solis 21126* (US). **Loja:** between Loja and San Lucas, 6 Sep. 1923, *A. S. Hitchcock 21488* (US). **Pinchincha:** 41 km S of Quito, 13 Apr. 1990, *P. M. Peterson, C. R. Annable & M. Poston 8730* (US). **Tungurahua:** Entre Yambo y Ambato, 20 Oct. 1944, *M. Acosta-Solis 8561* (US). PARAGUAY. **Central:** Asunción, Jardín Botánico, Nov. 1917, *Rojas 3069* (US). PERU. **Amazonas:** Prov. Bongara, SW of Pomacocha, 16 June 1962, *J. J. Wurdack 855* (US). **Ancash:** Prov. Bolognesi, Pariarraccra, 2 May 1952, *E. Cerrate 1473* (US). **Arequipa:** Arequipa, 22 Nov. 1923, *A. S. Hitchcock 22430* (US). **Cajamarca:** Prov. San Miguel, Cerro Quillon, 5 July 1986, *J. Mostacero L., E. Alvitez I., S. Leiva G., F. Mejia C. & F. Pelaez P. 1247* (US). **Cuzco:** Prov. Quispicanchis, near Oropesa, 2 Mar. 1963, *D. & V. Ugent 4029* (US). **Huancavelica:** Prov. Huancavelica, Izcuchaca, 16 Apr. 1955, *O. Tovar 2484* (US). **Junín:** between Oroya and La Merced, 24 Oct. 1923, *A. S. Hitchcock 22159* (US). **Lima:** Prov. Huarochiri, Infiernillo, 10 May 1984, *D. N. Smith, R. Ferreyra & O. Tovar 7007a* (US). **Madre de Dios:** Juliaca, 26 Feb. 1914, *H. U. Harlan s.n.* (US). **Puno:** Lake Titicaca, 4 June 1954, *Monheim s.n.* (US). URUGUAY. **Montevideo:** American Consulate, Montevideo, 29 Nov. 1925, *E. M. Marsh 17* (US). VENEZUELA. **Federal District:** Galipan, Dec. 1932, *Tamayo 9* (US). **Lara:** Depto. Jimenez, near Agua Negre, 11 Mar. 1979, *C. Burandt Jr., B. Garofalo & E. Cotton VO568* (US). **Mérida:** between Mucuruba and Paramo de Mueuchies, 22 Jan. 1922, *A. Jahn 774b* (US).

Morphologically highly variable and ecologically diverse, this variety was introduced as a forage crop and is now widely adventive in North America. The common name of *Bromus catharticus* var. *catharticus* in the United States is rescue grass; in Argentina it is "Cebadilla, Cebadilla criolla, or Cebadilla australiana." The synonymy, in part, follows Pinto-Escobar (1986) and Zuloaga et al. (1994), otherwise, "Syn. nov." is indicated.

Acknowledgments. We are grateful to Robert J. Soreng for reviewing this manuscript. Special thanks are given to Susan C. Escher for her skillful illustrations.

Literature Cited

Abbott, L. S., P. Pistorale & R. Wolff. 1996. Variabilidad fenotípica y estructura poblacional en *Bromus catharticus* Vahl (cebadilla criolla). Jornadas Argentinas de Botánica 25 (Resum.): 329.

Armstrong, K. C. 1991. Chromosome evolution in *Bromus*. Pp. 336–377 *in* T. Tsuchiya & P. K. Gupta (editors), Chromosome Engineering in Plants: Genetics, Breeding, Evolution, Part B. Elsevier, Amsterdam.

Aulícino, M. B. & M. F. Arturi. 1996. Clasificación de poblaciones de *Bromus catharticus* Vahl utilizando carácteres de alta constancia y herabilidad. Jornadas Argentinas de Botánica 25 (Resum.): 331.

Cladera, J. 1979. Polimorfismo isoenzimático y variación para la longitud de anteras en la cebadilla (*Bromus unioloides* HBK). Tesis Magister Scientiae. Escuela de Graduados Ciencias Agropecuarias, INTA Castelar, Argentina.

Clayton, W. D. & S. A. Renvoize. 1986. Genera Graminum. Kew Bull. Add. ser. 13: 1–389.

Doyle, J. J., J. L. Doyle & A. H. D. Brown. 1990a. A chloroplast-DNA phylogeny of the wild perennial relatives of soybean (*Glycine* subgenus *Glycine*): Congruence with morphological crossing groups. Evolution 44: 371–389.

———, ——— & ———. 1990b. Chloroplast DNA phylogenetic affinities of newly described species in *Glycine* (Leguminosae: Phaseoleae). Syst. Bot. 15: 466–471.

Gutierrez, H. F., J. F. Pensiero & A. C. Vegetti. 1996. Tipología de inflorescencia del género *Bromus* L. (Poaceae: Poeae). Jornadas Argentinas de Botánica 25 (Resum.): 186.

Matthei, O. 1986. El género *Bromus* L. (Poaceae) en Chile. Gayana, Bot. 43: 47–110.

Naranjo, C. A. 1992. Estudios biosystemáticos en especies de *Bromus* (sección *Ceratochloa*, Poaceae). I. Sistemas reproductivos y barreras de aislamiento. Darwiniana 31: 173–183.

Nicora, E. G. 1978. Gramineae. *In* M. N. Correa (editor), Flora Patagónica Part III. Colección Científica del INTA 8: 1–563.

Pahlen, A. W. von der, J. V. Crisci, W. Telleria Polo & F. Pérez López. 1980. Clasificación de poblaciones de cebadilla criolla (*Bromus unioloides*) y la cebada boliviana (*Hordeum vulgare*). Actas IV Congr. Latinam. Genética 2: 207–211.

Pavlick, L. 1995. *Bromus* L. of North America. Royal British Columbia Museum, British Columbia, Canada.

Pérez López, F. 1975. Studio de variabilidad de *Bromus unioloides* de diferentes habitats. Tesis Magister Scientiae, Escuela Graduados Ciencias Agropecuarias, INTA Castelar, Argentina.

Pillay, M. & K. W. Hilu. 1995. Chloroplast-DNA restriction site analysis in the genus *Bromus* (Poaceae). Amer. J. Bot. 82: 239–249.

Pinto-Escobar, P. 1976. Nota sobre el ejemplar tipo de "*Bromus catharticus*" Vahl. Caldasia 11: 9–16.

———. 1986. El género *Bromus* en los Andes Centrales de Suramerica. Caldasia 15: 15–34.

Planchuelo, A. M. 1991. Estudios sobre el complejo *Bromus catharticus* (Poaceae) I. Evaluación estadística de los carácteres taxonómicos. Kurtziana 21: 243–257.

Ragonese, S. 1967. Vegetación y Ganadería de la República Argentina. Colección Científica del INTA 5.

——— & P. R. Marcó. 1941. Observaciones sobre la biología floral de la cebadilla criolla. Revista Argent. Agron. 8: 196–199.

——— & ———. 1943. Influencia del fotoperíodo sobre la formación de flores cleistógamas y chasmógamas en cebadilla criolla. Revista Argent. Agron. 10: 178–185.

Raven, P. H. 1960. The correct name for rescue grass. Brittonia 12: 219–221.

Seberg, O. 1989. Genome analysis, phylogeny, and classification. Pl. Syst. Evol. 166: 159–171.

Soderstrom, T. R. & J. H. Beaman. 1968. The genus *Bromus* (Gramineae) in Mexico and Central America. Publ. Mus. Michigan State Univ. 3(5): 469–519.

Stebbins, G. L. 1956. Cytogenetics and evolution in the grass family. Amer. J. Bot. 43: 890–905.

———. 1981. Chromosomes and evolution in the genus *Bromus* (Gramineae). Bot. Jahrb. Syst. 102: 359–379.

——— & H. A. Tobgy. 1944. The cytogenetics of hybrids in *Bromus*. 1. Hybrids within section "*Ceratochloa*." Amer. J. Bot. 31: 1–11.

Tovar, O. 1993. Las Gramíneas (Poaceae) del Perú. Ruizia 13: 1–480.

Tsvelev, N. N. 1976. Grasses of the Soviet Union, part 1: 298–343. Nauka Publishers, Leningrad. [English translation published by Amerind Publishing, New Delhi, 1983.]

Wolff, R., L. Abbott & S. Pistorale. 1996. Reproductive behavior of *Bromus catharticus* Vahl (Cebadilla criolla) in natural and cultivated populations. J. Genet. Breed. 50: 121–128.

Zuloaga, F. O., E. G. Nicora, Z. E. Rúgolo de Agrasar, O. Morrone, J. Pensiero & A. M. Cialdella. 1994. Catálogo de la Familia Poaceae en la República Argentina. Monogr. Syst. Bot. Missouri Bot. Gard. 47: 1–178.

Amyris oblanceolata (Rutaceae), a New Species from Nicaragua

Amy Pool
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Amyris oblanceolata*, a new species from northwestern Nicaragua, is described, and its relationships to other Central American species with opposite, trifoliolate leaves are discussed.

The genus *Amyris* consists of approximately 40 species distributed in the West Indies and from Florida and Texas through Central America to Peru and Venezuela. They are unarmed trees or shrubs with the leaves opposite, or alternate, and 1–11-foliolate; the flowers small, generally perfect and actinomorphic with 3–5 petals and 6–10 free stamens; and the fruits one-seeded drupes. Species found in South America were revised by Gereau (1991). A new species of *Amyris* from Central America was encountered during preparation of a treatment of Rutaceae for the *Flora de Nicaragua* and is here described.

Amyris oblanceolata A. Pool, sp. nov. TYPE: Nicaragua. Depto. de Estelí: Estelí, elevation 1600 ft., 21 Feb. 1957 (buds and imm. fr), *J. B. Salas & B. W. Taylor 2267* (holotype, EAP).

Frutex vel arbor parva. Folia opposita, trifoliolata, foliolis oblanceolatis vel ellipticis, apice acutis vel rotundatis, retusis, coriaceis. Inflorescentia multiflora, pseudoterminalis, paniculata, ramis pubescentibus, floribus sessilibus.

Shrub or small tree, 2–7 m tall, the young branches puberulent. Leaves opposite to subopposite, trifoliolate; leaflets oblanceolate to elliptic, acute to rounded at the apex, with retuse tip, cuneate at base, 5–9 cm long, 2–3.5 cm wide with terminal leaflet larger than laterals, entire, coriaceous, glabrous except midrib puberulent above, with numerous pellucid punctations, the veins reticulate, conspicuous and raised on both surfaces, lateral leaflets sessile or on petiolules to 2 mm, the petiolule of terminal leaflet 4–12 mm; petiole 1.5–3.5 cm, not winged, puberulent. Inflorescence many-flowered, pseudo-terminal, paniculate, the branches densely puberulent, the flowers sessile in dense clusters, the buds globose; calyx 4-lobed, the lobes triangular, acute at apex; petals 4, glabrous; stamens 7 or 8 in two series, the filaments glabrous; gynophore present; ovary with a few hairs at base.

Species of *Amyris* found in Central America south of Mexico with opposite or subopposite, trifoliolate (or occasionally trifoliolate) leaves are: *A. oblanceolata*, *A. guatemalensis* Lundell, members of the *A. elemifera* species complex, and *A. brenesii* Standley.

Amyris oblanceolata is most similar to *A. guatemalensis* Lundell, known only from the type, a fruiting collection from Alta Verapaz, Guatemala. *Amyris guatemalensis* is similar to *A. oblanceolata* in having subcoriaceous leaflets, an unusual condition in this genus, and short pedicels. *Amyris guatemalensis* differs from *A. oblanceolata* in having leaves that are generally 5-foliolate with the lateral leaflets distinctly petiolulate and the tertiary veins neither raised nor conspicuous on the adaxial surface. The leaflets of *Amyris guatemalensis* are generally elliptic with acuminate apices but sometimes are (like those of the new species) oblanceolate with rounded and retuse apices.

Members of the *Amyris elemifera* species complex (including: *A. elemifera* L., *A. balsamifera* L., and *A. vestita* Lundell) differ from *A. oblanceolata* in having membranous to chartaceous leaflets and distinctly pedicellate flowers. In addition, their leaflets are generally suborbicular to lanceolate with acute to acuminate apices. The application of names and species circumscription within this group is discussed by Lundell (1960) and Gereau (1991).

Amyris brenesii Standley (including *A. costaricensis* Standley), endemic to Costa Rica, is easily distinguished from other species of *Amyris* from Central America by its large lateral leaflets, 14–26 cm long, and its long petioles, 9–24 cm long.

Paratypes. NICARAGUA. **Jinotega:** Sierra W of Jinotega, along road to Cerro de la Cruz, elevation 1050–1350 m, chiefly in dense wet mixed low forest, 27 June 1947 (sterile), *P. C. Standley 10177* (EAP). **Matagalpa:** El Eden, camino viejo a Jinotega, 12°58′N, 85°58′W, elevation 856 m, 1 Feb. 1984 (buds), *P. P. Moreno 22909* (HNMN, MO).

Acknowledgments. I thank W. D. Stevens, Roy Gereau, and Jacquelyn Kallunki for advice and encouragement, and Roy Gereau for assistance in preparing the Latin description.

Literature Cited

Gereau, R. E. 1991. El género *Amyris* (Rutaceae) en América del Sur, con dos especies nuevas de la Amazonia occidental. Candollea 46: 227–235.

Lundell, C. L. 1960. Plantae Mayanae—I. Notes on collections from the lowlands of Guatemala. Wrightia 2: 49–63.

Notes on Central American *Scutellaria* (Lamiaceae)

Amy Pool
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Scutellaria ebracteata*, in section *Cardinalis* Epling, from Nicaragua, and *S. tenuipetiolata* in section *Uliginosae* Epling, from Costa Rica, are described, and identification keys to section *Cardinalis* as found in Honduras, Nicaragua, and Costa Rica and section *Uliginosae* as found in Nicaragua and Costa Rica are provided. The identity of *Scutellaria nicaraguensis* Sessé & Mociño is discussed, and the type locality of *S. purpurascens* var. *heterophylla* Bentham is clarified and its affinity to other taxa is considered.

In the course of preparing treatments of Lamiaceae for the floras of Nicaragua and Costa Rica, specimens representing two new species of *Scutellaria* were found, significant range extensions of other species were encountered, and two poorly understood names were clarified.

Scutellaria ebracteata A. Pool, sp. nov. TYPE: Nicaragua. Depto. de Matagalpa: Macizos de Peñas Blancas, SE side, drainage of Quebrada El Quebradon, slopes N and W of Hacienda San Martín, ca. 13°14–15′N, 85°38–39′W, 1000–1400 m, 18–20 Jan. 1982 (fl), *W. D. Stevens with P. Moreno & T. Elmquist 21115* (holotype, MO; isotype, HNMN not seen). Figure 1.

Species nova *Scutellariae glabrae* E. Leonard similis sed ab ea corolla purpurea monate, tubi cum galea 2.7–3.1 mm longa, tubo anguste infundibulari non saccato differt.

Weak shrub (or herb), 1–1.5 m, young branches with dense small, curving hairs. Leaves wide-elliptic, elliptic-oblong, or slightly pandurate, short-acuminate to obtuse at apex, rounded to cordate and often slightly asymmetrical at base, 7.7–13.5 cm long, 2.6–7 cm wide, margin sub-entire to serrate, adaxial surface glabrous, abaxial surface glabrous or with minute hairs on primary and secondary veins; medial petioles 1.5–5 cm long, shorter to longer than adjacent internodes. Inflorescence a terminal raceme, 4.5–10 cm long; flowers 15–25, loosely spiraled, pendulous; bracts deciduous prior to anthesis, pedicel 2–3 mm long; calyx 3.5–4.5 mm long, minutely puberulent or glabrous, scutellum 1.2–2 mm high; corolla reddish-purple, tube with galea 2.7–3.1 cm long, tube narrow-funnelform, arcuate, non-saccate, 1–2 mm wide at base to 5–7 mm wide at apex, lower lip 3–5 mm long. Fruiting calyx with lower lip to 5 mm long, scutellum to 4 mm high; nutlets (immature?) tan, nearly smooth.

Paratypes. NICARAGUA. **Jinotega:** Macizos de Peñas Blancas, along trail between finca of Socorro Mejia and finca of Luis Manzanares, ca. 13°16–17′N, 85°40–41′W, 1350–1650 m, cloud forest on gentle to steep slopes, 14 Jan. 1979 (fl buds), *W. D. Stevens 11339* (HNMN not seen, MO); Fila Piedra Pelona, al S del Cerro Kilambé, 13°34′N, 85°41′W, 1500–1665 m, bosque enano, 28 Mar. 1981 (young fr), *P. Moreno 7798* (HNMN not seen, MO); San Ramón, lado E de las faldas del Cerro Kilambé, 13°34′N, 85°40′W, 800–900 m, 24 Mar. 1981 (fl), *P. Moreno 7409* (HNMN not seen, MO); Cerro Kilambé, falda E del Pico Piedra Pelona, 13°34′N, 85°40′W, 1300–1400 m, bosques húmedos, 28 Mar. 1981 (fl), *P. Moreno 7784* (HNMN not seen, MO); Kilambé, Cerro San Pedro, 13°36′N, 85°39′W, 600–800 m, 25 Mar. 1981 (fl buds, young fr), *P. Moreno 7535* (HNMN not seen, MO); Flor de Liz, al W del Cerro Kilambé, 13°35′N, 85°40′W, 700–900 m, 24 Mar. 1981 (fl, fr), *P. Moreno 7430* (MO). **Zelaya:** Cerro Saslaya a unos 25 km al oeste de Siuna, 1200 m, Oct. 1977 (fl), *A. J. Ferguson 2* (MO); Cerro Saslaya, 20 km W of Siuna, 1100–1400 m, along eastern ridge of mountain, cloud forest, 5 May 1977 (fl buds), *D. Neill 1832* (MO).

Epling (1942) treated all *Scutellaria* species with large (tube with galea 16–60 mm) red flowers, known at that time from Central America south of Mexico, as members of section *Cardinalis* Epling. Paton (1990) treated the same species as *Scutellaria* sect. *Scutellaria* species-groups "speciosa" (in part) and "costaricana." These species are all large herbs or weak shrubs, often straggling, with leaves glabrous or sparingly hirsute above, and racemes with flowers spirally arranged in the axils of the deciduous to long persistent bracts, the corollas large and showy, orange-red, scarlet or bright red, and often arcuate. Epling recognized the five species treated here, except *S. ebracteata.* However, the species are difficult to separate and have been treated in various ways in modern Central American floras. *Flora of Guatemala* (Standley & Williams, 1973) treated *S. isocheila* Donnell Smith and *S. glabra* E. Leonard as synonyms of *S. longifolia* Bentham. *Flora of Costa Rica* (Stand-

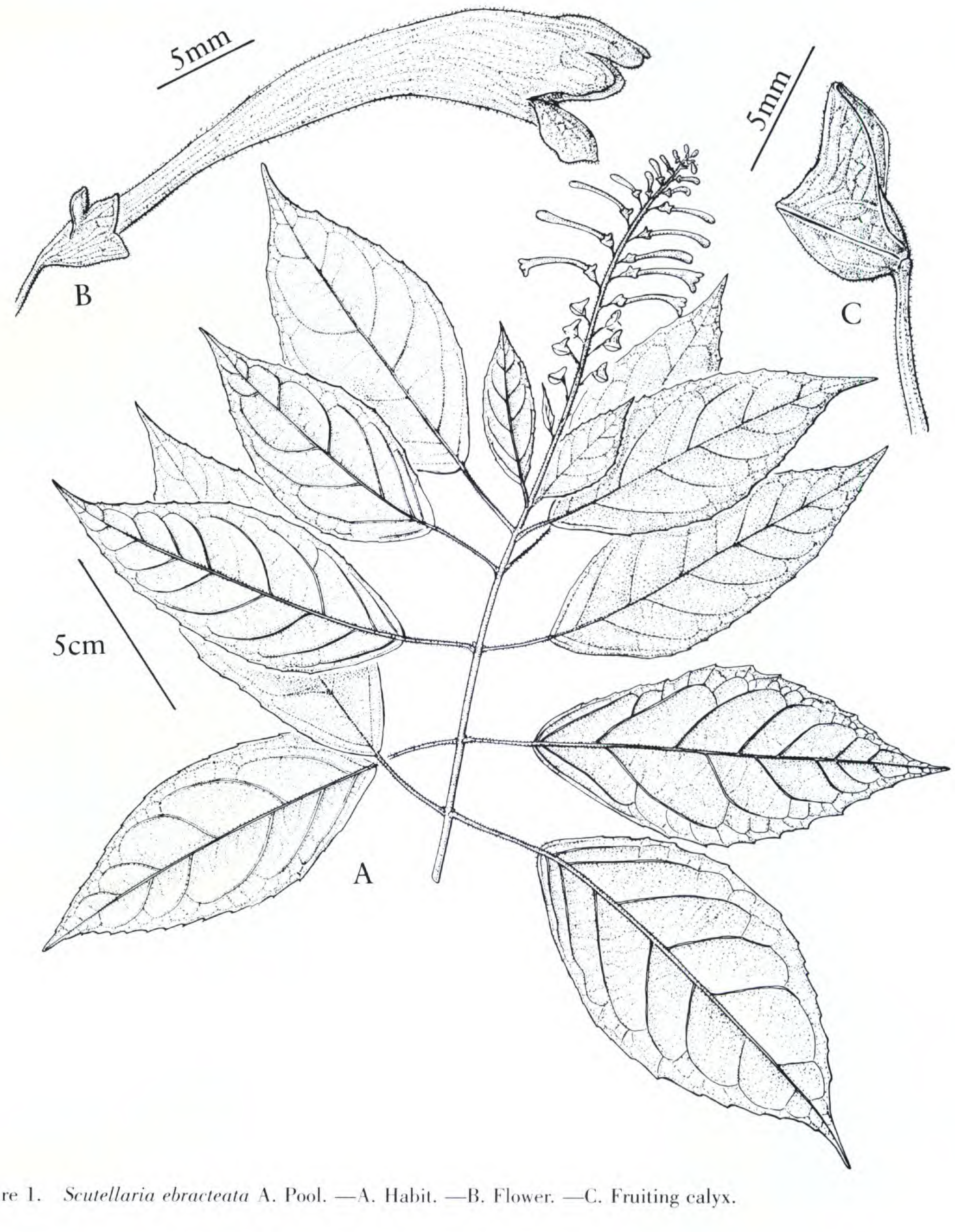


Figure 1. *Scutellaria ebracteata* A. Pool. —A. Habit. —B. Flower. —C. Fruiting calyx.

ley, 1938) recognized *S. glabra* but treated *S. isocheila* as a synonym of *S. longifolia*. To clarify my concepts, a key to the species of *S.* sect. *Cardinales* found in Honduras, Nicaragua, and Costa Rica is provided. *Scutellaria longifolia*, as here circumscribed, is restricted to southwestern Mexico and western Guatemala. It is recognized by having lanceolate leaves with cuneate (to rarely rounded and shortly decurrent) bases, and flowers that are ascending to spreading and spirally arranged in the axils of caducous bracts, with orange corollas of medium size (tube with galea 25–32 mm) with straight (to slightly sigmoid) tubes that are not saccate at the base. *Scutellaria hookeri* Epling is now known from Costa Rica, based on *L. O. Williams et al. 28585* (F) collected in the Cordillera de Talamanca. *Scutellaria hookeri*, known then only from Peru, was treated by Epling as a member of section *Coccineae* Epling (*Scutellaria* sect. *Scutellaria* species-group "speciosa" (in part) of Paton, 1990). It differs from members of section *Cardinales* only in having pilose to vil-

lous hairs on the abaxial leaf surface; *S. hookeri* is treated here as a member of section *Cardinalis* and included in the key.

KEY TO THE SPECIES OF *SCUTELLARIA* SECT. *CARDINALES* IN HONDURAS, NICARAGUA, AND COSTA RICA

1a. Inflorescence bracts deciduous before or at anthesis; corolla tubes saccate above base or not; leaf bases cordate, subcordate, or rounded.
  2a. Corolla tube with galea 46–60 mm, orange-red with yellow or orange lobes; flowers erect, congested, and corymbiform; known from Costa Rica and Panama . . . . . *S. costaricana* H. Wendland (including *S. argentata* E. Leonard)
  2b. Corolla tube with galea 16–31 mm, dark red or reddish purple; flowers spreading to pendent, loosely spiraling.
    3a. Corolla reddish purple, tube with galea 27–31 mm, tube not saccate; endemic to Nicaragua . . . . . *S. ebracteata* A. Pool
    3b. Corolla dark red, tube with galea 16–23 mm, tube saccate on one side at 3–4 mm above base; known from Costa Rica and Panama . . . . . *S. glabra* E. Leonard
1b. Bracts persistent into and beyond fruiting; corolla tubes not saccate above base; leaf bases attenuate to rounded or cordate.
  4a. Inflorescence without glandular-capitate hairs; corolla tube with galea 20–34 mm, bright pink; leaves with attenuate bases, glabrous above; endemic to Costa Rica . . . . . *S. isocheila* Donnell Smith
  4b. Inflorescence with glandular-capitate hairs; corolla tube with galea 19–40 mm, rose or orange-red to bright red; leaves with rounded to cordate bases, scattered hirsute above (at least along margin).
    5a. Corolla tube with galea 19–26 mm, rose to red; calyx long-villous; leaves with subcordate to cordate bases and with long (to ca. 1 mm) curly or wavy hairs on surface below; known from Costa Rica, Colombia, and Peru . . . . . *S. hookeri* Epling
    5b. Corolla tube with galea 32–40 mm, orange-red to bright red; calyx short-hispid; leaves with rounded bases and with short straight hairs on surface below; known from Guatemala, Belize, and Honduras . . . . . *S. inflata* Epling

Scutellaria tenuipetiolata A. Pool, sp. nov. TYPE: Costa Rica. Limón Province: Cantón de Talamanca Amubri, camino entre Amubri y Soki, siguiendo el Río Ñabri hacia Alto Soki, 9°29′50″N, 82°59′10″W, 150 m, 1 July 1989 (fl, young fr), *Gerardo Herrera 3101* (holotype, MO; isotypes, CR not seen, F). Figure 2.

Species nova *Scutellariae purpurascente* Swartz similis sed ab ea petiolis medianis internodiis longioribus, foliis basi revera cordata, sinu usque ad ca. 3 mm profundo, bracteis estipitatis, corolla pallidiore, tubo albido, labiis azureis ad violaceis differt.

Small perennial herb with thickened fascicled roots, usually with several stems arising from a small caudex, stems densely puberulent. Leaves ovate, bluntly acute at apex, shallowly cordate at base with sinus to 3 mm deep, 3.5–5.6 cm long, 2–4 cm wide, margin crenulate (sinuate), adaxial surface nearly glabrous with scattered, coarse, jointed hairs, abaxial surface puberulent on primary and secondary veins; medial petioles longer than adjacent internodes, 2.5–4 cm long, less than 1 mm wide. Inflorescence a terminal raceme, 3.5–5.5 cm long, 4–12-flowered, flowers spiraled to subopposite at a node; rachis, bracts, pedicels, and calyces puberulent; bract persistent, elliptic, 2–3 mm long, exstipitate; pedicel 1–2.5 mm long; calyx 2.5–3 mm long, scutellum 1.5–2 mm high; corolla with white tube and blue to purple lips, tube with galea 14–16 mm long, tube 1 mm wide at base to 3 mm wide at apex, lower lip 3–4 mm long. Fruiting calyx with lower lip to 4 mm long, scutellum to 5 mm high; nutlets brown, smooth to sub-papillate.

Scutellaria tenuipetiolata is found in wet, weedy areas.

Paratypes. COSTA RICA. **Limón:** Cordillera de Talamanca, Cantón de Matina, 200 m aguas abajo de la confluencia de Quebrada Cañabral con Río Barbilla, margen derecha, siguiendo el curso de la Quebrada Camagre, 10°00′10″N, 83°25′30″W, 100 m, 5 Nov. 1988 (fl), *G. Herrera 2283* (CR not seen, F, MO); near the Río Catarata (Río Sand Box) in the hills between BriBri on the Río Sixaola and the Caribbean coastal plain, 9°37′N, 82°49′W, 50–100 m, 28–29 Nov. 1975 (fl bud, fr), *R. Baker & W. Burger 39* (F, MO); arriba de la catarata del Río Sand Box, Talamanca, 200 m, 17 July 1982 (fr), *J. Gomez-Laurito 8732* (F); entre Limón et María, Sep. 1899 (fr and fl), *H. Pittier 16013* (K not seen, US).

All the species of *Scutellaria* with small (tube with galea 11–18 mm) bluish or purplish flowers found in Nicaragua and Costa Rica are treated by Epling (1942) as members of section *Uliginosae* Epling (*Scutellaria* sect. *Scutellaria* "species-group uliginosa" of Paton, 1990). They are all small herbs (generally less than 50 cm tall), with fascicled-thickened roots and several stems arising from a small caudex or slightly elongated rhizome. The leaves are thinly hirsute above, with stout-jointed hairs, and puberulent at least on the veins below. The flowers are spiraled to sub-verticillate in the axils of bracts on a short raceme with the corollas small, purple or blue, or white with blue or purple lips.

Epling recognized two species of *Scutellaria* sect. *Uliginosae* in Costa Rica. He included the newly described *S. tenuipetiolata*, as represented by *Pit-*

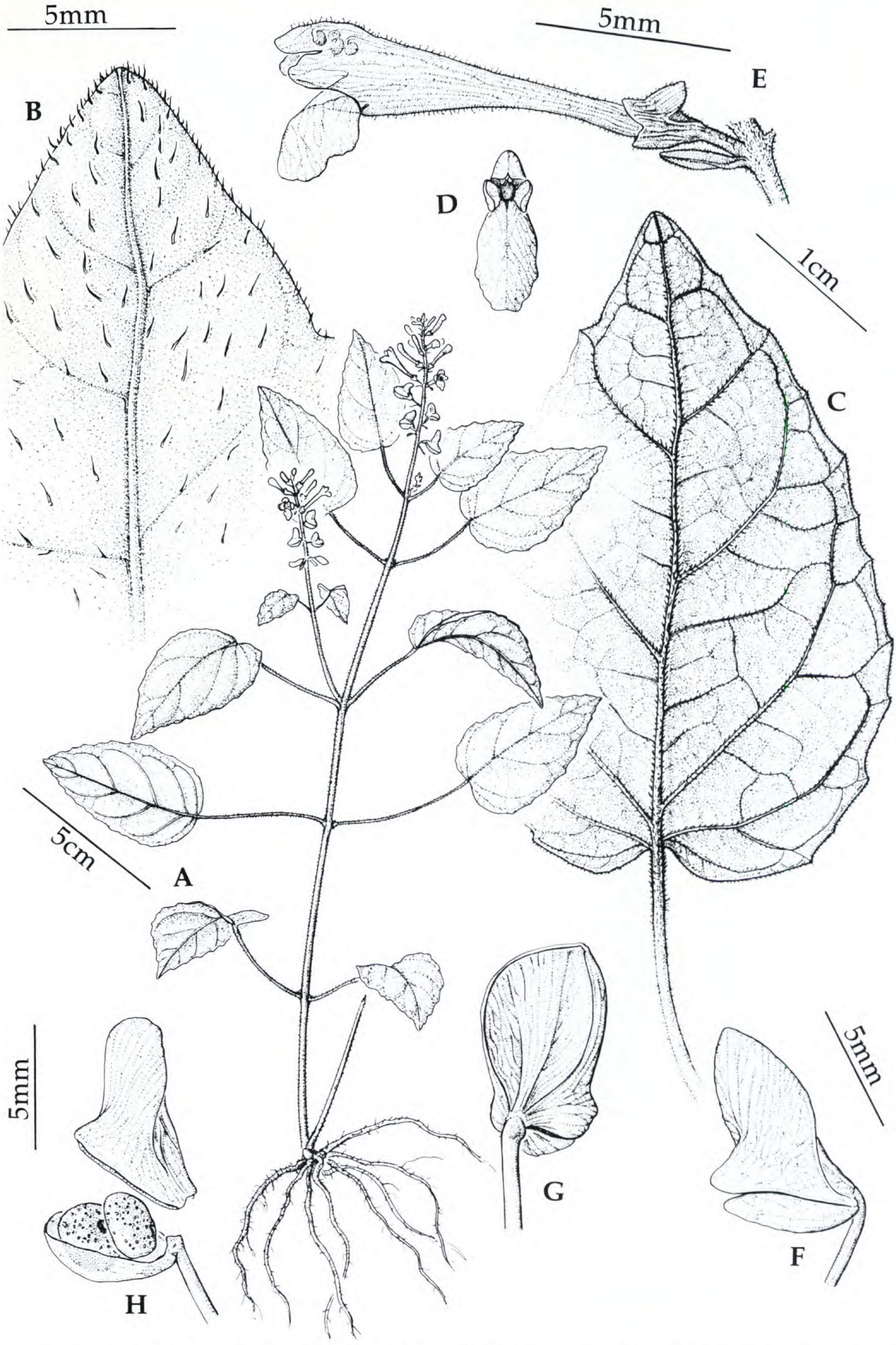


Figure 2. *Scutellaria tenuipetiolata* A. Pool. —A. Habit. —B. Adaxial leaf surface. —C. Abaxial leaf surface. —D. Flower, front view —E. Flower, lateral view. —F. Fruiting calyx, lateral view. --G. Fruiting calyx, back view. —H. Fruiting calyx with nutlets.

tier 16013, in his concept of *S. purpurascens* Swartz. This group was not known from Nicaragua. Four species are now known from Costa Rica, while one, *S. galerita* Epling, has been found in Nicaragua.

Epling treated *Scutellaria purpurascens* var. *heterophylla* Bentham as a synonym of *S. guatemalensis* E. Leonard, but it is here maintained in *S. purpurascens*. However, insufficient material of *S. purpurascens* over its entire range has been examined to determine whether a varietal distinction is warranted. *Scutellaria guatemalensis* differs from *S. purpurascens* in its exstipitate bracts and dense, relatively long hairs on stems, leaf abaxial surface, and calyx. It is not known south of Guatemala. Epling may have been misled into believing that the holotype of *S. purpurascens* var. *heterophylla*, *Friedrichsthal s.n.* (K), was from modern-day Guatemala. Most Friedrichstahl specimens are labeled as from Guatemala; only the original set retained at W indicate actual collection locality and number. Examination of the holotype, the Friedrichsthal collections at W, and a photocopy of Friedrichsthal's fieldnotes suggests that the holotype of *S. purpurascens* var. *heterophylla* is a duplicate of *Friedrichsthal 1299* (W), collected at San José, Costa Rica.

Scutellaria orichalcea Donnell Smith was placed by Epling in *Scutellaria* sect. *Pallidiflorae* Epling, based on the color of the corolla, white or white with lips yellowish green or bluish to purplish tinted; it is here treated as a member of section *Uliginosae*. Specimens of *S. orichalcea* from the north of Nicaragua are found from 150 to 1000 m and have corollas 19–24 mm long, that are white or white with yellow-green lips. Collections from Costa Rica are found at and above 1400 m and have slightly smaller corollas, 15–19 mm long, that are white with bluish or purplish lips or tints. If further investigation confirms these observations, recognition of the Costa Rican entity as a distinct subspecies might be recommended.

Key to the Species of *Scutellaria* Sect. *Uliginosae* in Nicaragua and Costa Rica

1a. Leaves with bases cordate; medial petioles generally longer than adjacent internodes.
  2a. Inflorescence with some glandular-capitate hairs; leaves deeply cordate (sinus 5–10 mm); petioles 1.2–2 mm wide . . . . . *S. galerita* Epling
  2b. Inflorescence without glandular-capitate hairs; leaves shallowly cordate (sinus 1.5–3 mm); petioles 0.3–0.75 mm wide . . . . . *S. tenuipetiolata* A. Pool
1b. Leaves with bases cuneate to truncate; medial petioles shorter than adjacent internodes.
  3a. Corolla red-purple (blue); racemes with flowers in many-flowered verticels (especially dense at apex); bracts stipitate; leaves ovate, less than two times as long as wide . . . . . *S. purpurascens* Swartz
  3b. Corolla white with bluish, purplish, or yellow-greenish lips or tints; racemes with flowers spiraling or opposite; bracts exstipitate; leaves lanceolate, two or more times as long as wide . . . . . *S. orichalcea* Donnell Smith

Neither Leonard (1927) nor Epling (1942) treated the name *Scutellaria nicaraguensis*, described by Sessé and Mociño in *Flora Mexicana* (1894), as from "Legione" (equivalent to León, Nicaragua, according to McVaugh, 1977). No illustrations or specimens bearing this name have been located. The description is more compatible with *Ocimum campechianum* P. Miller than with any species of *Scutellaria* known from Central America or expected to be found in the dry forests in the area of León; I therefore suggest that synonymy.

Acknowledgments. I thank W. D. Stevens and Michael Grayum for advice and encouragement, Roy Gereau for reviewing the Latin diagnosis, and John Myers for providing the illustrations. I also thank the curators of BM, F, K, OXF, and US for specimen loans and the curators at F, MA, and the Hunt Institute for Botanical Documentation for searching for material of *Scutellaria nicaraguensis*.

Literature Cited

Epling, C. 1942. The American species of *Scutellaria*. Univ. Calif. Publ. Bot. 20: 1–145.

Leonard, E. 1927. The North American species of *Scutellaria*. Contr. U.S. Natl. Herb. 22: 703–748.

McVaugh, R. 1977. Botanical results of the Sessé & Mociño expedition (1787–1803). I. Summary of excursions and travels. Contr. Univ. Michigan Herb. 11: 97–195.

Paton, A. 1990. A global taxonomic investigation of *Scutellaria* (Labiatae). Kew Bull. 45: 399–450.

Sessé, M. & J. M. Mociño. 1894. Flora Mexicana, 2nd ed. Oficina tipográfica de la Secretaría de Fomento, México.

Standley, P. C. 1938. Labiatae. *In:* Flora of Costa Rica. Publ. Field Mus. Nat. Hist., Bot. Ser. 18(3): 1015–1035.

——— & L. O. Williams. 1973. Labiatae. *In:* L. O. Williams et al., Flora of Guatemala. Fieldiana, Bot. 24(9): 237–317.

Stenopadus andicola Sp. Nov. (Asteraceae: Mutisieae), a New Generic Record for Ecuador

John F. Pruski

United States National Herbarium, Department of Botany, MRC-166, Smithsonian Institution, Washington, D.C. 20560-0166, U.S.A.

ABSTRACT. A new species, *Stenopadus andicola* (Asteraceae: Mutisieae), is described from the Cordillera del Condor, Ecuador. It is the first member of the genus reported outside the Guayana Highland and is a new generic record for Ecuador. *Stenopadus andicola* is placed in section *Stenopadus*.

The genus *Stenopadus* S. F. Blake (Asteraceae: Mutisieae) contains 15 species, 14 of these occurring in the Guayana region of Brazil, Colombia, Guyana, and Venezuela (Pruski, 1991 [1993]; Pruski, 1997), principally on sandstone. No species of *Stenopadus* were listed as occurring in the Andes in treatments of the Mutisieae for Colombia (Díaz-Piedrahita & Vélez-Nauer, 1993), Ecuador (Harling, 1991), Peru (Ferreyra, 1995), or Venezuela (Aristeguieta, 1964). The description of a fifteenth species, *S. andicola*, marks the first report of the genus from outside the Guayana region and the first report of the genus in Ecuador and the Andes. *Stenopadus* thus joins *Gongylolepis* R. H. Schomburgk as Guayana-centered Mutisieae genera with a sole species occurring in the Andes. In Pruski (1997: 365), the occasion was taken to mention *S. andicola* in passing. The new species is named prior to its use in the forthcoming *Catalogue of the Vascular Plants of Ecuador*, coordinated by P. M. Jørgensen and S. León.

The Mutisieae contain some of the most primitive species of Asteraceae, and the "ancestral asteraceous plant" illustrated in Bremer (1994) is *Stenopadus*-like. Important primitive features found in the Guayana-centered Mutisieae include arborescent habit, thick fleshy leaves (taken as a mechanical deterrent, in light of the weak protective chemistry of the group), large homogamous capitula with florets that are bird-pollinated, sometimes paleate receptacles, short rounded style branches with a single stigmatic surface and without collecting hairs, anthers without a distinct apical appendage, and smooth prolate pollen (Pruski, 1991 [1993]).

Stenopadus andicola Pruski, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Cantón Nangaritza, Valle del Río Nangaritza, Miazi, bosque sobre pendientes fuertes de roca caliza o de pizarra, bosque primario, muy denso, 4°18′S, 78°40′W, 1200 m, 10 Dec. 1990 (fr), *W. Palacios 6712* (holotype, US; isotypes, MO, QCNE not seen). Figure 1.

Arbol usque 15 m alta; caules sericei vel glabrati; folia alterna, petiolata; petioli 1.5–4 cm longi tenui non-amplexicauli; foliorum lamina coriacea oblanceolata vel obovata 8–24 cm longa 2–7.5 cm lata integra pinnativenia sericea vel glabrata; capitula solitaria sessilia vel brevipedunculata epaleacea homogama, flosculis ca. 25 hermaphroditis; involucrum cylindricum vel anguste campanulatum 3.9–4.5 cm longum ca. 2.2 cm latum 6–7-seriatum; phyllaria imbricata sericea vel apicalis glabrata; receptaculum planum epaleaceum ca. 1 cm diam.; corollae ignotae; achaenia cylindrica ca. 10 cm longa glabra; pappi setae numerosae multiseriatae usque 20 mm longae.

Trees to 15 m tall, to 20 cm diam.; *stems* subterete, grooved, sericeous when young to glabrate, leafy distally, leafless proximally, internodes to 3 cm long. *Leaves* simple, alternate, often apically clustered, petiolate; *petiole* 1.5–4 cm long, thin and non-clasping; *blade* rigid-coriaceous, oblanceolate to obovate, 8–24 cm long, 2–7.5 cm wide, apically broadly acute to rounded, narrowly cuneate basally, margins entire, thickened, somewhat revolute, venation pinnate, reticulate or third-order veins sometimes obscure, the upper blade surface dark green, midrib commonly sericeous to puberulent, upper surface otherwise puberulent when young to glabrous, the lower blade surface pale green, midrib sericeous to weakly so, lower surface otherwise sericeous when young to nearly glabrous. *Capitula* solitary, terminal, sessile to shortly pedunculate, homogamous, ca. 25-flowered, florets bisexual; *peduncle* 0–0.5 cm long and not much exserted above the bases of the subtending leaves, the subtending leaves deciduous and upper node or two with elongating axillary branch(es) when capitula in fruit, the peduncle then leafless with capitula 5 cm above axillary branch(es) and uppermost leaves; *involucre* cylindrical to narrowly campanulate, 3.9–4.5 cm

Figure 1. Isotype (*Palacios 6712*, MO) of *Stenopadus andicola* Pruski.

long, ca. 2.2 cm wide, 6–7-seriate; *phyllaries* ca. 40, imbricate, graduated, tightly appressed and rigidly erect, coriaceous, sericeous or apex sometimes glabrate, entire, the outer phyllaries keeled, triangular-ovate, 0.5–1 cm long, 0.4–0.6 cm broad, apex acute or obtuse, the inner phyllaries weakly keeled, elliptic-lanceolate to lanceolate, ca. 3 cm long, 3.5–5 mm wide, apex narrowly acute; *receptacle* flat, epaleaceous, ca. 1 cm diam. *Corollas* unknown. *Cypselas* (achenes) nearly cylindrical, mostly 5-angled, ca. 10 mm long, brown, glabrous; pappus setae numerous, several-seriate, linear, stramineous, to 20 mm long, about twice as long as the cypselas.

Distribution and ecology. *Stenopadus andicola* is known only from two collections in late fruit in October and December. The specimens in QCNE were not seen, but Walter Palacios (pers. comm.) says that they too are in late fruit. These collections were made in cloud forests from 1100 to 1200 m elevation on the Cordillera del Condor in the province of Zamora-Chinchipe, Ecuador. The Cordillera del Condor is largely sandstone, but *S. andicola* has been collected only in quartzite or slate areas. The Cordillera del Condor is considered among the oldest geologic formations in Ecuador (Peter Jørgensen, pers. comm.), and is important biogeographically; it is home to several other Guayana disjuncts [e.g., *Everardia montana* Ridley ex Thurn (Cyperaceae), *Paepalanthus dichotomus* Klotzsch ex Körnicke (Eriocaulaceae), *Perama* Aublet (Rubiaceae), *Pterozonium brevifrons* (A. C. Smith) Lellinger (Pteridaceae), and *Pterozonium reniforme* (Martius) Fée (Pteridaceae)] (John Wurdack, pers. comm.).

This new species is known only from fruiting material, but is referred to actinomorphic-flowered *Stenopadus* by its arborescent habit with unarmed stems, large coriaceous leaves with thin, non-clasping petioles, non-plumose pappus, large capitula, and keeled phyllaries. The corollas of species of *Stenopadus* are mostly red, and the corolla lobes are flexuous or coiled and about as long as the corolla tubes. By its keeled phyllaries, *S. andicola* resembles *S. chimantensis* Maguire, Steyermark & Wurdack, *S. connellii* N. E. Brown, and *S. sericeus* Maguire & Aristeguieta. The three latter species are placed in section *Connellia* Maguire & Wurdack and are confined to the tepuis of the eastern Guayana Highland. *Stenopadus sericeus* has reticulate, abaxially sericeous leaves, further resembling *S. andicola*. However, the leaves of *S. chimantensis*, *S. connellii*, and *S. sericeus* are stoutly petiolate, thus these three species are readily distinguished from *S. andicola*. The new species is not considered to be a member of section *Connellia* sensu Maguire et al. (1957).

By thinly petiolate, large, occasionally abaxially sericeous leaves, *Stenopadus andicola* appears to be most closely related to *S. colombianus* Cuatrecasas & Steyermark (a Colombian endemic, and the nearest geographic relative of *S. andicola*) and the widespread *S. talaumifolius* S. F. Blake, both of section *Stenopadus* sensu Maguire et al. (1957). However, the leaves of the new species are weakly (vs. strongly) reticulate and commonly (vs. occasionally) abaxially sericeous, thus differing from both *S. colombianus* and *S. talaumifolius*. The phyllaries of *S. andicola* are sericeous (or the innermost sometimes apically glabrate) and keeled, which further distinguishes it from *S. colombianus* and *S. talaumifolius*, both of which have non-keeled, glabrous phyllaries, or rarely with the outermost phyllaries sericeous. The leaves of *S. cucullatus* Maguire (sect. *Stenopadus*) resemble those of *S. andicola*, but *S. cucullatus* differs from the new species by its weakly seriate, apically obtuse to rounded phyllaries. The new species is presumed to be a member of section *Stenopadus*.

Paratype. ECUADOR. **Zamora-Chinchipe:** Cantón Nangaritza, Detrás del Campamento Militar de Miazi (oeste), bosque nublado con árboles cubiertos completamente de hepáticas y musgos, estrato del bosque 15 m de altura, Dystropept. arenisca cuarzosa meteorizada, 4°16′S, 78°42′W, 1100 m, 21 Oct. 1991 (fr), *W. Palacios et al. 8551* (MO, QCNE not seen).

Acknowledgments. I thank Peter Jørgensen, Harold Robinson, John Wurdack, and an anonymous reviewer for helpful discussion and comments.

Literature Cited

Aristeguieta, L. 1964. Compositae. *In:* T. Lasser (editor), Fl. Venezuela 10: 1–941.

Bremer, K. 1994. Asteraceae: Cladistics & Classification. Timber Press, Portland, Oregon.

Díaz-Piedrahita, S. & C. Vélez-Nauer. 1993. Revisión de las tribus Barnadesieae y Mutisieae (Asteraceae) para la Flora de Colombia. Monogr. Jard. Bot. José Celestino Mutis 1: xi + 1–162.

Ferreyra, R. 1995. Family Asteraceae: Part VI [Tribe Mutisieae]. *In:* J. F. Macbride & Collaborators, Flora of Peru. Fieldiana, Bot. n.s., 35: v + 1–101.

Harling, G. 1991. Compositae–Mutisieae. *In:* G. Harling & L. Andersson (editors), Flora of Ecuador 42: 1–105.

Maguire, B., J. J. Wurdack & Collaborators. 1957. The botany of the Guayana Highland—Part II. Mem. New York Bot. Gard. 9: 235–392.

Pruski, J. F. 1991 [1993]. Compositae of the Guayana Highland—V. The Mutisieae of the Lost World of Brazil, Colombia, and Guyana. Bol. Museu Paraense, sér. Bot. 7: 335–392.

———. 1997. Asteraceae. Pp. 177–393 *in* J. A. Steyermark, P. E. Berry & B. K. Holst (editors), Flora of the Venezuelan Guayana, Vol. 3. Missouri Botanical Garden, St. Louis.

New Names in Chinese Apiaceae

PU Fa-ting
Chengdu Institute of Biology, Chinese Academy of Sciences,
Chengdu, Sichuan 610041, People's Republic of China

ABSTRACT. A new name in *Peucedanum*, a new variety of *Ostericum scaberulum*, and four new combinations in *Meeboldia*, *Hydrocotyle*, and *Oenanthe* are proposed. They are: *Peucedanum franchetii* C. Y. Wu & Pu, *Ostericum scaberulum* (Franchet) Yuan & Shan var. *longiinvolucellatum* C. Y. Wu & Pu, *Meeboldia yunnanensis* (H. Wolff) Constance & Pu, *Hydrocotyle burmanica* Kurz subsp. *craibii* (H. Eichler) C. Y. Wu & Pu, *Oenanthe javanica* (Blume) DC. subsp. *rosthornii* (Diels) Pu, and *Oenanthe thomsonii* C. B. Clarke subsp. *stenophyllum* (Boissieu) Pu.

The nomenclature of several taxa of various genera of Apiaceae (Umbelliferae) needs adjustment. The nomenclatural changes are herein proposed to make the names available for the forthcoming volume 14 of the *Flora of China*.

Ostericum scaberulum (Franchet) Yuan & Shan var. **longiinvolucellatum** C. Y. Wu & Pu, var. nov. TYPE: China. Yunnan: Degen, Baima Snow Mount, among shrubs, Sep. 1935, *C. W. Wang 69408* (holotype, KUN).

A varietate *scaberulo* differt involucellorum phyllis umbellulis longioribus et latioribus ca. 1 mm latis.

Variety *longiinvolucellatum* differs from variety *scaberulum* in having bractlets ca. 1 mm broad and longer than the fruiting umbellets. Variety *scaberulum* has bractlets ca. 0.5 mm broad and shorter than the pedicels and fruiting umbellets. The name *longiinvolucellatum* was first proposed as a nomen nudum in Wang (1993).

Paratypes. CHINA. **Yunnan:** Zongdian, 2780 m, with grasses and other herbs, 3 Aug. 1962, *Likiang Bot. Gard. 100752* (KUN), Degong meadows, 3300 m, in shrubs, 3 Sep. 1959, *K. M. Feng 23510* (KUN).

Peucedanum franchetii C. Y. Wu & Pu, nom. nov. Replaced name: *Peucedanum heterophyllum* Franchet, Bull. Soc. Philom. Paris, ser. 8, 6: 141. 1894, not Visiani, Cat. Sem. Hort. Patav. 4. 1836. TYPE: China. Yunnan: Likiang, 3000 m, Oct. 1884, *Delavay 192* (holotype, P).

Peucedanum franchetii is proposed to replace *P. heterophyllum* Franchet, which is a later homonym of *P. heterophyllum* Visiani.

Meeboldia yunnanensis (H. Wolff) Constance & Pu, comb. nov. Basionym: *Sinodielsia yunnanensis* H. Wolff, Notizbl. Bot. Gart. Berlin-Dahlem 9: 278. 1925. TYPE: China. Yunnan: Yunnan-fu, *Cavalerie 42?* (holotype, B).

Meeboldia (Wolff, 1924) and *Sinodielsia* (Wolff, 1925) share the same principal generic characters: strongly developed calyx teeth, narrowly ovoid fruit attenuate toward style and slightly constricted at the commissure, 2 or 3 vittae in each furrow and 4 on the commissure, sulcate seed face, 3- or 4-pinnatisect leaves, 5–10 rays that are 4–5 cm long, and an involucel of 5–7 linear-lanceolate bractlets. On the basis of their morphological similarities and geographical distribution in the Himalayas and southwestern China, it is concluded that *Sinodielsia* should be reduced to synonymy of the earlier published *Meeboldia*.

Hydrocotyle burmanica Kurz subsp. **craibii** (H. Eichler) C. Y. Wu & Pu, comb. nov. Basionym: *Hydrocotyle craibii* H. Eichler, Feddes Repert. 98: 146. 1987. New name for *Hydrocotyle chinensis* L. 1753, not *H. shanii* Boufford, Acta Phytotax. Sin. 28: 331. 1990, superfluous name. TYPE: China. Yunnan: Mengzi, woods, 8500 ft., *A. Henry 10224* (holotype, K).

Subspecies *craibii* differs from subspecies *burmanica* in having orbicular-reniform, 5–7-lobed leaves. Both subspecies show a south to north trend from shallowly to deeply lobed leaves.

Hydrocotyle craibii H. Eichler and *H. shanii* Boufford (see Eichler, 1987; Boufford, 1990) were both proposed independently as new names for *H. chinensis* (Dunn ex R. H. Shan & Liou) Craib ex Tardieu-Blot, which is a later homonym of *H. chinensis* L. (1753).

Oenanthe javanica (Blume) DC. subsp. **rosthornii** (Diels) Pu, stat. nov. Basionym: *Oenanthe rosthornii* Diels, Bot. Jahrb. Syst. 29: 498. 1900. TYPE: China. Guizhou: Ping-fa, 21 Aug. 1902, *J. Cavalerie 176* (neotype, E).

Oenanthe javanica subsp. *rosthornii* differs from subspecies *javanica* by its unequal rays, lanceolate involucel bractlets, and ovoid fruit. In subspecies *javanica* the rays are subequal, the involucel bractlets are linear, and the fruit is oblong.

Oenanthe thomsonii C. B. Clarke subsp. **stenophyllum** (Boissieu) Pu, stat. nov. Basionym: *Oenanthe dielsii* Boissieu var. *stenophylla* Boissieu, Bull. Acad. Int. Géogr. Bot. 16: 185. 1906. TYPE: China. Sichuan: Cheng kou, *Farges s.n.* (holotype, P; isotype, K).

Because of its homomorphic, finely 3- or 4-pinnate leaves, linear pinnae, and subglobose fruits, subspecies *stenophyllum* is more at home in *Oenanthe thomsonii* than in *O. dielsii*. *Oenanthe dielsii* has 1- or 2-pinnate hetermorphic leaves and linear, lanceolate, or rhomboid-ovate pinnae.

Acknowledgment. I thank Ihsan Al-Shehbaz for his help with the manuscript.

Literature Cited

Boufford, D. E. 1990. *Hydrocotyle shanii* Boufford, a new name for *H. chinensis* of authors, not L. (Apiaceae). Acta Phytotax. Sin. 28: 331–332.

Eichler, H. 1987. Nomenclatural and bibliographical survey of *Hydrocotyle* L. (Apiaceae). Part II. Feddes Repert. 98: 145–196.

Wang, W. T. 1993. Vascular Plants of Hengduan Mountains Vol. 1. Science Press, Beijing.

Wolff, H. 1924. *Meeboldia*, genus novum umbelliferarum Himalayicum. Repert. Sp. Nov. Regni Veg. 19: 313.

———. 1925. Neue Umbelliferen-Gattungen aus Ostasien. Notizbl. Bot. Gart. Berlin-Dahlem 9: 275–280.

Two New Species of *Larnax* (Solanaceae) from Ecuador

Neil W. Sawyer

Department of Ecology and Evolutionary Biology, The University of Connecticut, Box U-43, 75 North Eagleville Road, Storrs, Connecticut 06269, U.S.A.

ABSTRACT. Two new species of *Larnax* (Solanaceae) are described and illustrated. *Larnax andersonii* is a small shrub with unequal, geminate leaves and long, bifurcate hairs. It occurs along the eastern slopes of the Ecuadorian Andes. The flower structure of *L. andersonii* is similar to another Ecuadorian species, *L. suffruticosa*. *Larnax psilophyta*, a high-elevation species endemic to southern Ecuador, is a small-flowered, glabrous shrub with indurate, fleshy leaves that is often confused with *Deprea glabra*.

The genus *Larnax* (Miers) Hunziker, first described by Miers (1849), has 12 known species and is among a group of approximately 12 so-called "physaloid" genera in the large tribe Solaneae (Averett, 1979; D'Arcy, 1991). This group, which not surprisingly includes the large genus *Physalis* L., is united by having longitudinally dehiscent anthers, ovarial nectaries, and accrescent calyces that surround and either closely invest or inflate around the berry. Recent molecular systematic work suggests subtribal status of this physaloid clade may be justified (Olmstead & Palmer, 1992; Olmstead & Sweere, 1994).

Species of *Larnax* are single-trunked shrubs 30 cm–2 m tall. Although infrequent in most habitats, they easily are recognized by their plagiotropic upper stem and leaf growth and by the axillary fascicles of from 1 to several flowers per node. Corolla color ranges from cream to yellow to purple and is variable within species (Sawyer, unpublished). Fruits are fleshy, orange berries usually containing from 60 to over 100 small seeds. *Larnax* is taxonomically associated with the genus *Deprea* Raffinesque (Barboza & Hunziker, 1994; Hunziker, 1977). Heteranthery in *Larnax* species is one character that delimits this genus from *Deprea*. In species of *Deprea*, anthers in the same flower are of equal size, whereas in species of *Larnax*, the five anthers are grouped in arrays of either two or three different size classes. Other characters that separate these genera include the presence of thickened filament bases forming a stamen petalum (Barboza & Hunziker, 1991) in *Larnax* species (filament bases are never thickened in *Deprea*), and the degree of corolla fusion (in *Deprea* corollas are infundibular, the limb shorter than the tube; in *Larnax* corollas are always rotate-campanulate, the limb always longer than the tube) (Barboza & Hunziker, 1994; Sawyer, unpublished).

Species of *Larnax* are tropical, Andean shrubs of limited distribution occurring from Colombia to northern Peru, with eight species in Ecuador, five of which are endemic. Recently, a new species was described extending the range into Venezuela (Benítez de Rojas & Martínez, 1995). Species of *Larnax* inhabit wet, premontane or montane forest edges and usually are found on slopes along streams.

In addition to the species described herein, the following ten species comprise the genus:

Larnax harlingiana Barboza & Hunziker. 1995. Kurtziana 24: 157–160. Distribution: Ecuador.

Larnax hawkesii Hunziker. 1977. Kurtziana 10: 7–50. Distribution: Colombia and Ecuador.

Larnax hunzikeriana Benítez & Martínez. 1995. Phytologia 78: 353–356. Distribution: Venezuela.

Larnax lutea Leiva. 1996. Arnaldoa 4: 15–22. Distribution: Peru.

Larnax peruviana (Zahlbruckner) Hunziker. 1977. Basionym: *Athenaea peruviana* Zahlbruck. 1892. Ann. K. K. Naturhist. Hofmus 7: 7. Distribution: Ecuador and Peru.

Larnax purpurea Leiva. 1996. Arnaldoa 4: 15–22. Distribution: Peru.

Larnax sachapapa Hunziker. 1977. Kurtziana 10: 7–50. Distribution: Colombia and Ecuador.

Larnax steyermarkii Hunziker. 1977. Kurtziana 10: 7–50. Distribution: Ecuador.

Larnax subtriflora (Ruiz & Pavón) Miers. 1849. Basionym: *Physalis subtriflora* Ruiz & Pavón. 1794. Fl. Per. 2: 42. Distribution: Peru.

Larnax suffruticosa (Dammer) Hunziker. 1977. Basionym: *Iochroma suffruticosa* Dammer. 1905. Bot. Jahrb. 36: 386. Distribution: Ecuador.

Larnax andersonii N. W. Sawyer, sp. nov. TYPE: Ecuador. Napo: km 25 of Hollín–Loreto road, finca entrance next to bridge over a quebrada in secondary pluvial forest, 950 m, 00°40′S, 77°40′W, 1 July 1995, *Sawyer & Tirado 714* (holotype, MO; isotypes, CONN, US). Figure 1.

Inter quaterni species ceteris generis fructu involuto laxe calyce trichomatibus longis et interdum ramosis, ra-

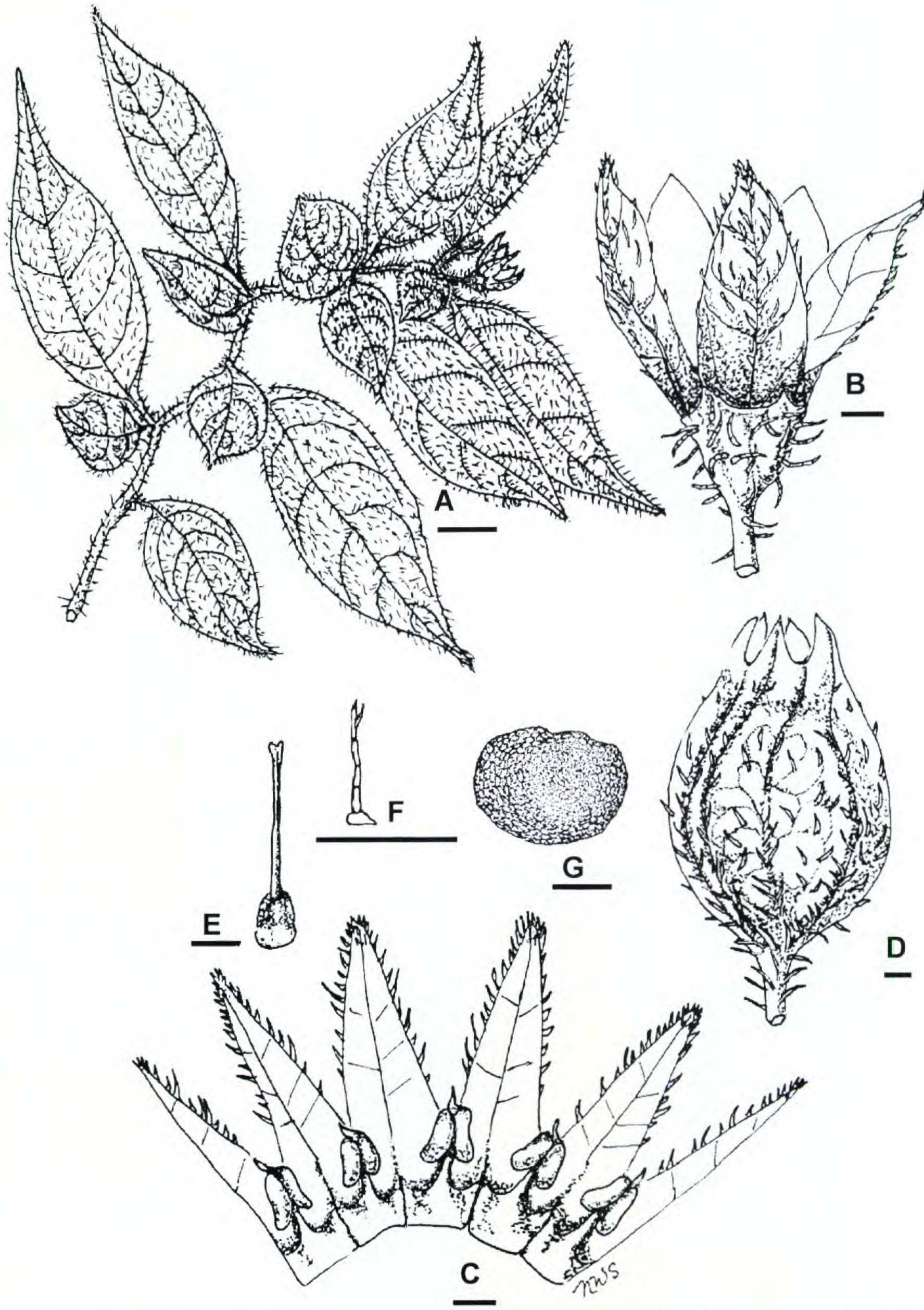


Figure 1. *Larnax andersonii* N. W. Sawyer (*Sawyer 714*). —A. Branch apex. Bar = 1 cm. —B. Mature flower. —C. Interior of mature corolla and androecium. —D. Mature fruiting calyx. —E. Mature gynoecium with annular nectary at base. —F. Bifurcate leaf trichome. —G. Mature seed. Bars B–F = 1 mm.

mis secundariis geniculatis, foliis geminatis disparibus, floribus solitariis et distalibus in ramis, corollis luteolis aut purpuratis, antheris apiculatis sed recedens ab isdem.

Suffrutescent perennial, 0.5–2 m tall. Stems branched, secondary branches geniculate. Stems and leaves villous–sericeous, covered with long, multicellular, simple or occasionally branched trichomes. Leaves membranous, entire, paired, unequal, the larger (major) elliptic, 4.5–11 cm long, 1.6–3.9 cm wide with 5–8 secondary veins, the smaller (minor) elliptic-ovate–ovate, 0.3–2.5 cm long, 0.6–1.9 cm wide. Leaves strigose-sericeous above, villous–sericeous below especially along veins, bifurcate hairs occurring occasionally along leaf margin and along veins; apex acuminate in major leaves, acute–mucronate in minor leaves, base oblique–equal, attenuate in major leaves, sometimes attenuate–truncate in minor leaves. Petiole

sericeous, 3–10 mm long on major leaves, 0.5–3 mm long on minor leaves. Inflorescence distal on the branch, axillary, typically solitary, occasionally paired. Flowers pendent on sericeous pedicels 3–5 mm long. Flowering calyx villous–sericeous, green, 1.5–2 mm long, 2.5–3 mm wide, margin ranging from broadly pyramidal at the 5 major veins to 5-lobed, lobes acute, <1 mm long. Corolla campanulate, 6–8 mm long, tube 2–3 mm long, lobes of the limb membranous, narrowly triangular, sparsely villous externally, densely tomentose along margin and at apex, bifurcate hairs occurring rarely externally and along margin, glabrous within. In shade plants, corolla pale yellow–cream–green; in sun plants, corolla violet with cream base. Stamens included. Filaments glabrous, filamentose, the free portion 1.6–2 mm long, adnate to the basal third of the corolla and there broadened and thickened into a stamen petalum with projections at the shoulders, separated from each other by the corolla vasculature, fused portion 0.9–1.8 mm long. Anthers white–pink, ovate with long apiculum, occurring in two size arrays of three large and two small, 1.3–1.6 mm long, 0.75 mm wide, slightly dorsifixed, base sagittate. Ovary glabrous, ovate, 1 mm long, less than 1 mm wide, ringed basally by a greenish yellow nectary. Style glabrous, 2–4 mm long, extending beyond anthers late in anthesis; stigma clavate–subbilobate, green–purple. Fruiting pedicels sericeous, 5 mm long. Fruiting calyx accrescent, loosely enveloping the fruit, open at the apex, green with dark green veins, villous, membranous, pyriform, 1.2–1.3 cm long, 0.8–1 cm wide, with scattered, two-celled glandular hairs within; lobes distinct, triangular, acute, unequal in length, to 2 mm long. Fruit an orange, fleshy berry containing 60–80 reniform, faveolate seeds to 2.8 mm diam.

A suite of characteristics are diagnostic for this species. They include the geniculate younger stems, a character present in many species of this group, and the distinctly unequal-geminate leaves on younger branches; the usually solitary flowers occurring distally on branches; the apiculate anthers also found in several species; and the long, sometimes bifurcate, multicellular hairs also found in *L. subtriflora* and *L. suffruticosa* (Sawyer, unpublished).

Distribution. In wet lower montane forest, usually on slopes next to streams. Limited to the eastern Andean slopes of north and central Ecuador, from 900 to 1500 m.

The specific epithet honors Gregory J. Anderson, whose dedicated and exhaustive research into the evolutionary and reproductive biology of the genus *Solanum* sect. *Basarthrum*, notably his groundbreaking work on cryptic dioecy, warrants recognition. His exemplary, broad-scaled investigations ranging in context from experimental research to applied systematic studies, including studies of pollen and hair types, have provided both inspiration and guidance for his students and colleagues.

Paratypes. ECUADOR. **Napo:** Archidona, faldas al sur del Volcán Sumaco, Carretera Hollín–Loreto, km 31, Comuna Challua Yacu, 1200 m, 00°43′S, 77°36′W, 8–17 Jan. 1989, *Alvarado 222* (NY); new road to Loreto (56 km S of Baeza), 28 km E of junction with Baeza–Tena Road, 1100 m, 00°50′S, 77°33′W, 21 Dec. 1988, *Hammel & Wilder 17263* (NY); El Chaco Canton, Proyecto Hidroeléctrico Coca, Punto ST3, márgen derecha del Río Quijos, 1500 m, 00°11′S, 77°39′W, 3–5 Oct. 1990, *Palacios 5805* (QCNE); El Chaco Canton, Proyecto Hidroeléctrico Coca, Punto ST4, márgen derecha del Río Quijos, ca 10 km al sur de Reventador, 1450 m, 00°08′S, 77°30′W, 6–10 Oct. 1990, *Palacios 6059* (QCNE). **Pastaza:** Hacienda San Antonia del Barón von Humboldt, 2 km al NE de Mera, 1300 m, 01°27′S, 78°06′W, 27 Feb.–19 Mar. 1985, *Baker, Neill, Palacios & Zaruma 5662* (MO, NY, QAME); along road from Puyo to Macas, ca. 33 km S of Puyo, 24.9 km S of Veracruz, 16 km S of Escuela Fiscal Cotopaxi, disturbed primary forest, 900 m, 01°38′S, 77°52′W, 3 May 1984, *Croat 58946* (NY).

Larnax psilophyta N. W. Sawyer, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Nudo de Sabanilla, pass on road from Yangana to Valladolid, 2800–2900 m, elfin forest and clearings, 5 Apr. 1985, *Harling & Andersson 23724* (holotype, NY). Figure 2.

Species rarissima a loco unico cognito inter quaterni species ceteris generis fructibus involutis arte calyce. Ab caulibus, ramis, et foliis glaberis omnino, foliis induratis ambo apice et base acutato, floribus parvulis usque 6 mm longis, corolla viridia-alba, antheris exsertis, calyce fructifero rotundo tantum 7 mm in diametro a speciebus descriptis fructibus involutis arte calyce notis bene distincta.

Suffrutescent perennial, 1–2 m tall. Stems branched, secondary branches geniculate. Stems and leaves entirely glabrous. Leaves somewhat indurate–fleshy, entire, elliptic, 4–5 cm long, 1–2 cm wide with 3–4 secondary veins prominent abaxially, apex acute, base cuneate, oblique; minute, stalkless, unicellular red glands occurring abaxially toward the leaf base. Petiole glabrous, 5–7 mm long. Inflorescence axillary, 1–3 flowers per node in fascicles from a much reduced peduncle, pendent on glabrous pedicels 6–7 mm long. Flowering calyx glabrous except at the apex where short hairs may be present, green, 1.5 mm long, 2.5 mm wide, margin broadly pyramidal at the 5 major veins. Corolla campanulate-rotate, 4.6–6.4 mm long, tube 1.5–2.8 mm long, lobes of the limb coriaceous, ovate-triangular, reflexed, margins and apex puberulent,

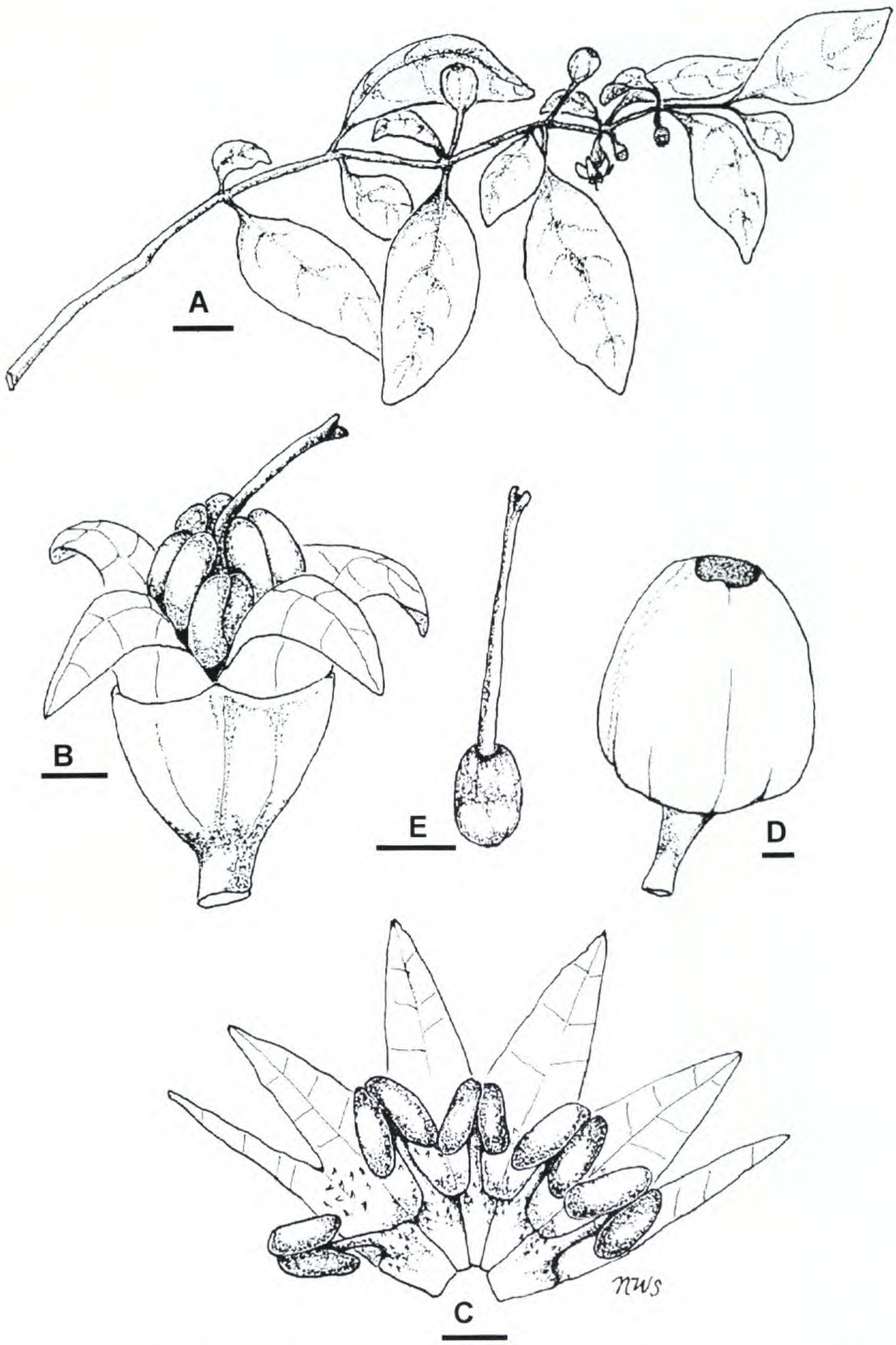


Figure 2. *Larnax psilophyta* N. W. Sawyer (*Harling & Andersson 23724*). —A. Branch apex. Bar = 1 cm. —B. Mature flower. —C. Interior of mature corolla and androecium. —D. Mature fruiting calyx. —E. Mature gynoecium with annular nectary at base. Bars B–E = 1 mm.

otherwise glabrous without, nonglandular, pluricellular finger hairs present in an annular ring at anther level within. Corolla pale yellow–cream–green. Stamens included. Filaments glabrous–puberulent, filamentose–ribbon-like, the free portion 1–1.5 mm long, adnate to the basal third of the corolla and there broadened and thickened forming a stamen petalum with extended shoulders, separated from each other by the corolla vasculature, the fused portion 0.8–1.4 mm long. Anthers white, ovate, minutely apiculate or, more commonly, without apiculum, occurring in two size arrays of three large and two small, 1.2–1.6 mm long, 1 mm wide, slightly dorsifixed, base somewhat sagittate. Ovary glabrous, ovate, 1 mm long, less than 1 mm wide, ringed basally by a greenish yellow nectary. Style glabrous, 3–4 mm long, extended beyond anthers late in anthesis; stigma clavate–subbilobate, green.

Fruiting pedicels glabrous, to 10 mm long, raising the mature fruit above the leaf plane. Fruiting calyx accrescent, tightly enveloping the fruit, open at the apex, green, glabrous, membranous, globose, 7 mm diam. with scattered, 2-celled, glandular hairs within; teeth short yet distinct, triangular, acute, <1 mm long. Fruit an orange, fleshy berry containing about 30, reniform, faveolate seeds to 2.6 mm diam.

Diagnostic characteristics for this species include the geniculate younger stems as in *L. andersonii*, the glabrous nature of the plant, the indurate leaves with acute apex and base, and the very small greenish white flowers. *Larnax psilophyta* is found at higher elevations than other known *Larnax* species and appears to be limited in occurrence to the Parque Nacional Podocarpus and the Nudo de Sabanilla areas of southern Ecuador. The specific epithet invokes the smooth texture of the foliage resulting from the combined effects of the indurate and glabrous conditions found in the foliage. This species has been consistently confused with *Deprea glabra*, another glabrous species found at high elevations in Ecuador. However, *D. glabra* has several features that allow it easily to be distinguished from *L. psilophyta*, viz., falcate leaves with attenuate base, a denser ring of pubescence within the much larger corolla tube, anthocyanins that are always present in the corolla, anther thecae with bases that are connate rather than sagittate, and a northerly Ecuadorian distribution.

Distribution. Endemic to the elfin cloud forest of the Parque Nacional Podocarpus and the Nudo de Sabanilla pass region at the border of Zamora–Chinchipe and Loja provinces in southern Ecuador, from 2500 to 3000 m.

Paratypes. ECUADOR. **Loja:** Parque Nacional Podocarpus, new road Loja–Zamora, E of Cerro Yanococha, montane forest along former Indian trail to Zamora, slightly disturbed, 2550–2650 m, 3°59′S, 79°07′W, 26 Nov. 1988, *Madsen 75581* (AAU, LOJA, QCA, QCNE). **Loja/Zamora–Chinchipe:** Parque Nacional Podocarpus, Road Yangana–Valladolid, km 21, vicinity of sample plot, 2700–2800 m, 4°28′S, 79°09′W, 24–25 Jan. 1989, *Madsen 85661* (AAU, LOJA, QCA, QCNE); Road Yangana–Valladolid, at entrance of Parque Nacional Podocarpus, 2500–3000 m, 4°28′S, 79°10′W, 10 Dec. 1989, *Madsen 86688* (AAU, LOJA, QCA, QCNE); Parque Nacional Podocarpus, pass on road Yangana–Valladolid (Nudo de Sabanilla), 2750–2900 m, 4°27′S, 79°08′W, 28 Feb. 1985, *Øllgaard et al. 58374* (AAU, LOJA, QCNE); Parque Nacional Podocarpus, Road Yangana–Valladolid, km 21, vicinity of sample plot, 2560 m, 4°28′S, 79°09′W, 31 July 1996, *Sawyer 770* (CONN, LOJA); Province boundary, pass over Nudo de Sabanilla, elfin forest, 2740 m, 4°27′S, 79°10′W, 11 May 1985, *Stein & D'Alessandro 2733* (K, NY).

Acknowledgments. This work would not have been possible without a grant for fieldwork from the Bamford Fund of the Department of Ecology and Evolutionary Biology, University of Connecticut. I thank the folks at the New York Botanical Garden and the Royal Botanical Gardens at Kew for loans of herbarium specimens; David Neill for providing me with a vehicle and a place to work in Ecuador; Milton Tirado for his navigational skills and mechanical assistance; Gregory Anderson, Antoni Damman, William D'Arcy, Kent Holsinger, Armando Hunziker, and Michael Nee for invaluable advice; and, finally, Mary Jane Spring for her assistance in the creation of the illustrations.

Literature Cited

Averett, J. E. 1979. Biosystematics of the physaloid genera of the Solaneae in North America. Pp. 493–503 *in* J. G. Hawkes, R. N. Lester & A. D. Skelding (editors), The Biology and Taxonomy of the Solanaceae. Academic Press, London.

Barboza, G. E. & A. T. Hunziker. 1991. Estudios sobre Solanaceae XXXI. Peculiaridades del androceo de interés taxonómico en *Solanum*. Kurtziana 21: 185–194.

——— & ———. 1994. Estudios sobre Solanaceae XXXVII. Sinopsis taxonómica de *Deprea*. Kurtziana 23: 101–124.

Benítez de Rojas, C. E. & M. Martínez. 1995. *Larnax hunzikeriana* (Solanaceae: Solanoideae). Una nueva especie y la primera mención del género para Venezuela. Phytologia 78: 353–356.

D'Arcy, W. G. 1991. The Solanaceae since 1976, with a review of its biogeography. Pp. 75–137 *in* J. G. Hawkes, R. N. Lester, M. Nee & N. Estrada (editors), Solanaceae III: Taxonomy, Chemistry, Evolution. Royal Botanic Gardens, Kew, and Linnaean Society of London.

Hunziker, A. T. 1977. Estudios sobre Solanaceae VIII. Novedades varias sobre tribus, géneros, secciones y especies de Sud America. Kurtziana 10: 7–50.

Miers, J. 1849. Contributions to the botany of South America. Ann. Mag. Nat. Hist. Ser. 2, 4: 37–39.

Olmstead, R. G. & J. D. Palmer. 1992. A chloroplast DNA phylogeny of the Solanaceae: Subfamilial relationships and character evolution. Ann. Missouri Bot. Gard. 79: 346–360.

——— & J. A. Sweere. 1994. Combining data in phylogenetic systematics: An empirical approach using three molecular data sets in the Solanaceae. Syst. Biol. 43: 467–481.

Nomenclatural Changes in *Leptochloa* P. Beauvois Sensu Lato (Poaceae, Chloridoideae)

Neil Snow

Washington University, Department of Biology, P.O. Box 1137, St. Louis, Missouri 63130, U.S.A. and
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.
Current Address: Queensland Herbarium, Meiers Road, Indooroopilly, QLD 4068, Australia
Email: Neil.Snow@env.qld.gov.au

ABSTRACT. The following new names are proposed for *Leptochloa* P. Beauvois s.l. (including *Diplachne* P. Beauvois), based on recent revisionary and cladistic studies: *Leptochloa caudata*, *L. decipiens* subsp. *asthenes*, *L. decipiens* subsp. *peacockii*, *L. eleusine*, *L. fusca* subsp. *muelleri*, *L. fusca* subsp. *fascicularis*, *L. fusca* subsp. *uninervia*, *L. gigantea*, and *L. panicea* subsp. *brachiata*.

Recent revisionary and cladistic studies in *Leptochloa* P. Beauvois (Snow, 1997a), along with preparation of the grass treatment for *Flora Zambesiaca* (Cope, in press), support nomenclatural changes for this nearly worldwide grass genus. The changes are necessary given the consistent lack of cladistic support for *Diplachne* P. Beauvois as a taxon distinct from *Leptochloa* (Snow, 1997a) and the need to reduce in rank several species (Snow, 1997a, 1997b).

The synonymy of *Leptochloa* is extensive and only recently has been assessed from a global perspective (Snow, 1997a). However, since the primary purpose of this article is to make these new names available, complete synonymy will be withheld for a later publication (or see Snow, 1997a). In addition to these changes, descriptions of two new species are forthcoming (Snow, 1998; Snow & Simon, 1997).

Leptochloa caudata (K. Schumann) N. Snow, comb. nov. Basionym: *Diplachne caudata* K. Schumann, in Engler, Pflanzenw. Ost.-Afrikas C: 113. 1895. TYPE: Tanzania. Ukera, *Fischer 674* (holotype, B).

Leptochloa decipiens (R. Brown) Stapf ex Maiden subsp. **asthenes** (Roemer & Schultes) N. Snow, comb. et stat. nov. Basionym: *Poa asthenes* Roemer & Schultes, Syst. Veg. 2: 574. 1817. *Poa imbecilla* R. Brown, Prodr. 181. 1810, nom. hom. illeg., non *P. imbecilla* Solander ex Sprengel, Pl. Nov. Herb. Spreng., 9 no. 14. 1807. *Leptochloa asthenes* (Roemer & Schultes) C. E. Hubbard, Bull. Misc. Inform. Kew: 26. 1941. TYPE: Australia. Queensland, Upper Head [=Chadron Point], Broad Sound, *R. Brown 6270* (lectotype, here designated, BM; isolectotype, K). Blake (1972: 6) correctly cited the type collection but did not designate a particular duplicate as the type specimen.

Eragrostis ciliolata Jedwabnick, Bot. Arch. 5(3–4): 192. 1924. *Leptochloa ciliolata* (Jedwabnick) S. T. Blake, Contr. Queensland Herb. 14: 6. 1092. TYPE: Australia. New South Wales, Narrabri, *Maiden s.n.* (lectotype [as holotype by Lazarides, 1980: 262], B; isolectotype, BRI).

My dissertation indicated that "*Eragrostis imbecilla* Benth. Fl. Austral. 7: 643. 1878, non *E. imbecilla* (R. Brown) R. Brown ex Steudel, Syn. Pl. Glumac. 1: 279. 1854" was a taxonomic synonym of *Leptochloa decipiens* subsp. *asthenes* (Snow, 1997a: 166). A few additional comments are useful at this time. Given the format used by Bentham (1878) in volume 7 of *Flora Australiensis*, *Eragrostis imbecilla* appears to be merely a new combination, not a new taxon (e.g., see Article 58.3, Greuter et al., 1994). This is evident from his citation of *Poa imbecilla* and explicit reference to the type specimen collected by Forster in New Zealand (holotype, B, Willdenow Herbarium Cat. No. 01896, microfiche). The correct citations for these names appear to be *Eragrostis imbecilla* (Solander ex

Sprengel) Bentham, which was based on *Poa imbecilla* Solander ex Sprengel (Veldkamp, pers. comm.; see also Hiepko, 1969; Garnock-Jones, 1986). The paniculate inflorescence of the type of *P. imbecilla* Solander ex Sprengel precludes its inclusion in *Leptochloa*, as does its origin from New Zealand, which lies beyond the normal range of the genus (Snow, 1997a). Although the clarity of the microfiche was inadequate for me to suggest the proper generic placement of the Forster collection, it clearly is not *Leptochloa*, and Blake (1972: 6) has ascribed the specimen back to *Poa*. Most importantly, names based on *Poa imbecilla* Solander ex Sprengel, including *Eragrostis imbecilla* Bentham, *Leptochloa debilis* Stapf ex C. E. Hubbard (Hubbard, 1941: 26), and *Poa sprengleii* Kunth (Kunth, 1833: 363) are to be excluded from *Leptochloa* (contra Snow, 1997a; Lazarides, 1997). It should be noted, however, that Hubbard (1941) considered *Eragrostis imbecilla* Bentham as a new taxon, not merely a new combination.

Leptochloa decipiens subsp. *asthenes* was formerly recognized at the species level as *Leptochloa ciliolata* (Lazarides, 1980; Stanley & Ross, 1989; Simon, 1993). Although it can be locally distinct in the field, all characters intergrade to some extent with *L. decipiens* subsp. *decipiens* (Snow, 1997a, 1997b).

Leptochloa decipiens subsp. **peacockii** (Maiden & Betche) N. Snow, comb. et stat. nov. Basionym: *Diplachne peacockii* Maiden & Betche, Agric. Gaz. New South Wales 15: 925. 1904. *Leptochloa peacockii* (Maiden & Betche) Domin, Biblioth. Bot. 85: 379. 1915. TYPE: Australia. New South Wales: Coolabah, 4 Dec. 1904, *Maiden & Boorman s.n.* (lectotype [as holotype by Lazarides], 1980: 263], NSW; isolectotypes, BM, BRI, K, W). As correctly noted by Blake (1972: 9), plate 2 in the original protologue is an erroneous element (Maiden & Betche, 1904), and represents the American species *Leptochloa dubia* Kunth.

This taxon has been recognized as *L. peacockii* (Stanley & Ross, 1989; Simon, 1993) or synonymized under *L. decipiens* subsp. *decipiens* (Lazarides, 1980). Like the previous taxon, some populations are distinct from *L. decipiens* subsp. *decipiens*, but in others morphological intergradation is continuous, such that no character or combination thereof can consistently diagnose it as a distinct species.

Leptochloa eleusine (Nees) T. A. Cope & N. Snow, comb. nov. Basionym: *Diplachne eleusine* Nees, Fl. Afr. Austr. 255. 1841. *Triodia eleusine* (Nees) T. Durrand & Schinz, Consp. Fl. Afr. 5: 877. 1894. *Uralepis eleusine* (Nees) Steudel, Syn. Pl. Glumac. 1: 248. 1854. TYPE: South Africa. Katrivierspoort, *Drège 3906* (lectotype, here designated, B; isolectotype, P).

Leptochloa fusca (L.) Kunth subsp. **muelleri** (Bentham) N. Snow, comb. et stat. nov. Basionym: *Diplachne muelleri* Bentham, Fl. Austral. 7: 619. 1878. *Leptochloa muelleri* (Bentham) Stace, Watsonia 18: 413. 1991. TYPE: Australia. Charlotte waters, *Giles s.n.*, Herb. Munro (lectotype, here designated, K; isolectotype, K).

Despite priority of the epithet *Leptochloa malabarica* (L.) Veldkamp over *fusca* (L.) Kunth (Veldkamp, 1971), Snow and Davidse (1998) have proposed rejection of *Poa malabarica* in the spirit of the Tokyo Code, which encourages maintenance of names in current use. This seems appropriate, given the nearly global geographic range of the species, the nearly universal historical usage of the epithet *fusca*, the restricted usage of the epithet *malabarica*, and the considerable confusion that has surrounded the application of the epithet *malabarica*.

The reduction in rank of this taxon and the two that follow is based on examination of several thousand herbarium specimens (representing over 50 herbaria) of this species complex from throughout its range, coupled with fieldwork in North America, southern Africa, and Australia, as well as multivariate statistical analyses of eleven population samples (Snow, in prep.).

Leptochloa fusca (L.) Kunth subsp. **fascicularis** (Lamarck) N. Snow, comb. et stat. nov. Basionym: *Festuca fascicularis* Lamarck, Tabl. Encycl. 1: 189. 1791. *Diplachne fascicularis* (Lamarck) P. Beauvois, Ess. Agrostogr. 81, 160, pl. 16, f. 9. 1812. *Cynodon fascicularis* (Lamarck) Raspail, Ann. Sci. Nat., Bot. 5: 303. 1825. *Festuca aquatica* Bosc ex Roemer & Schultes, Syst. Veg. 2: 615. 1817, nom. inval., as syn. of *Diplachne fascicularis* P. Beauvois. *Diplachne aquatica* Bosc ex Roemer & Schultes, Syst. Veg. 2: 615. 1817. TYPE: South America. *D. Richard s.n.* (holotype, P).

Leptochloa fusca (L.) Kunth subsp. **uninervia** (J. Presl) N. Snow, comb. et stat. nov. Basionym: *Megastachya uninervia* J. Presl, Reliq. Haenk. 1: 283. 1830. *Poa uninervia* (J. Presl) Kunth, Enum. Pl. 1: 344. 1833. *Eragrostis uninervia* (J. Presl) Steudel, Syn. Pl. Glumac. 1: 278. 1854. *Brizopyrum uninervium* (J. Presl) E. Fournier, Mex. Pl. 2: 121. 1886. *Leptochloa uninervia* (J. Presl) Hitchcock & Chase, Contr. U.S. Natl. Herb. 18(7): 383. 1917. *Diplachne uninervia* (J. Presl) Parodi, Revista Centro Estud. Agron. 18: 147. 1925. TYPE: Mexico. *Haenke 101* (lectotype, here designated, PR not seen; isolectotypes, W, LE not seen).

Leptochloa gigantea (Launert) T. A. Cope & N. Snow, comb. nov. Basionym: *Diplachne gigantea* Launert, Bol. Soc. Broteriana ser. 2a, 47: 349. 1974. TYPE: Zambia: Mbala (Abercorn), *Vesey-Fitzgerald 1551* (holotype, K; isotypes BM, SRGH not seen).

Leptochloa panicea (Retzius) Ohwi subsp. **brachiata** (Steudel) N. Snow, comb. et stat. nov. Basionym: *Leptochloa brachiata* Steudel, Syn. Pl. Glumac., 209. 1854. TYPE: Guadaloupe. *Duchassaing s.n.* (holotype, P, fragment US).

As recognized by Snow (1997a), *Leptochloa panicea* sensu lato is a polymorphic species that ranges throughout much of the warm temperate and tropical regions of the world. It is comprised of three subspecies.

Leptochloa panicea subsp. *panicea*, as recognized by Snow (1997a), corresponds closely to the taxon of the same name as recognized by Nowack (1994). It is an Old World taxon occurring mostly in Africa and southern Asia, but which has been verified recently from several duplicates collected at a site in northwestern Queensland, Australia (Snow, 1997a; Snow & Simon, in press).

Leptochloa panicea subsp. *brachiata*, as recognized by Snow (1997a), is by far the more common of the two New World subspecies in this complex and has a considerably larger range. It recently has been known as *L. filiformis* (Lamarck) P. Beauvois, *L. mucronata* (Snow & Davidse, 1993), and *L. panicea* subsp. *mucronata* (Michaux) Nowack (pro parte) (Snow & Davidse, 1993; Nowack 1994, 1995).

Leptochloa panicea subsp. *mucronata*, sensu Snow (1997a), is the correct name for the taxon formerly known as *Leptochloa attenuata* (Nuttall) Steudel (Allen, 1980) or *L. filiformis* var. *attenuata* (Nuttall) Steyermark & Kucera (Steyermark, 1963). This taxon is restricted to the U.S.A. in the central and lower portions of the Mississippi River drainage and portions of the Ohio River drainage to the east. The application herein of *L. panicea* subsp. *mucronata* (and Snow, 1997a) is in a narrower sense than that of Nowack (1994, 1995), who included all New World specimens under this name.

Acknowledgments. My sincere thanks to Gerrit Davidse of the Missouri Botanical Garden for assistance with the numerous and challenging nomenclatural puzzles in *Leptochloa*; however, any misinterpretations or oversights are mine. The prompt and thorough review by J. Veldkamp was much appreciated. Thanks also to the numerous curators who loaned herbarium specimens. Research was supported in part by the Missouri Botanical Garden (Mellon Foundation), Evolutionary and Population Biology Program at Washington University, and the National Geographic Society.

Literature Cited

Allen, C. M. 1980. Grasses of Louisiana. Univ. Southwestern Louisiana, Lafayette.

Bentham, G. 1878. Flora Australiensis: A description of the Plants of the Australian Territory. Vol. 7. Roxburghiaceae to Filices. L. Reeve, London.

Blake, S. T. 1972. *Plinthanthesis* and *Danthonia* and a review of the Australian species of *Leptochloa* (Gramineae). Contr. Queensland Herb. 14: 1–19.

Cope, T. A. In press. *In* Flora Zambesiaca: Flora terrarum Zambesii aquis conjunctarum, Vol. 10, E. Launert & G. V. Pope (editors).

Garnock-Jones, P. J. 1986. South Pacific plants named by K. P. J. Sprengel in 1807. Taxon 35: 123–171.

Greuter, W., F. R. Barrie, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva, P. Trehane & J. McNeill, Editors. 1994. International Code of Botanical Nomenclature (The Tokyo Code), Adopted by the XVth International Botanical Congress, Yokohama, August–September, 1993. Regnum Veg. 131.

Hiepko, P. 1969. Von J. R. und G. Forster gesammelte Pflanzen in Herbar Willdenow in Berlin. Willdenowia 5: 279–294.

Hubbard, C. E. 1941. Gramineae Australienses: III. Bull. Misc. Inform. (no volume number), 25–31.

Kunth, C. S. 1833. Enumeratio Plantarum. Tomus Primus. Stutgardiae et Tubingae. Sumitbus J. G. Cottae.

Lazarides, M. 1980. The genus *Leptochloa* Beauv. (Poaceae, Eragrostideae) in Australia and Papua New Guinea. Brunonia 3: 247–269.

———. 1997. A revision of *Eragrostis* (Eragrostideae, Eleusininae, Poaceae) in Australia. Austral. Syst. Bot. 10: 77–187.

Maiden, J. H. & E. Betche. 1904. A new Australian grass (*Diplachne Peacockii*, Maiden and Betche). Agric. Gaz. New South Wales 15: 925–926, plates 1, 2.

Nowack, R. 1994. Revision of *Leptochloa* Beauv. (incl. *Diplachne* Beauv.) in Malesia. Rheedea 4(2): 79–92.

———. 1995. A new combination in Malesian *Leptochloa* Beauv. Rheedea 5(1): 93.

Simon, B. K. 1993. A Key to the Australian Grasses. 2nd

ed. Queensland Department of Primary Industries, Brisbane.

Snow, N. 1997a. Phylogeny and Systematics of *Leptochloa* P. Beauvois sensu lato (Poaceae, Chloridoideae). Ph.D. Dissertation, Washington University, St. Louis, Missouri.

———. 1997b. Application of the phylogenetic species concept: A botanical monographic perspective. Austrobaileya 5: 1–8.

———. 1998. A new species of *Leptochloa* from Sri Lanka (Poaceae, Chloridoideae). Novon 8, in press.

——— & G. Davidse. 1993. *Leptochloa mucronata* is the correct name for *Leptochloa filiformis* (Poaceae). Taxon 42: 413–417.

——— & ———. 1998. Proposal to reject the name *Poa malabarica* (Gramineae). Taxon 47, in press.

——— & B. K. Simon. 1997. *Leptochloa southwoodii* (Poaceae: Chloridoideae), a new species from south-east Queensland. Austrobaileya 5: 137–143.

——— & ———. In press. Taxonomic status and Australian distribution of the weedy neotropical grass *Leptochloa fusca* subsp. *uninervia*, with an updated key to Australian *Leptochloa* (Poaceae, Chloridoideae). (Austrobaileya)

Stanley, T. D. & E. M. Ross. 1989. Flora of south-eastern Queensland. Volume III. Queensland Department of Primary Industries, Brisbane.

Steyermark, J. A. 1963. Flora of Missouri. Iowa State Univ. Press, Ames.

Veldkamp, J. F. 1971. Notes on Malesian grasses V. New species and combinations in *Pheidochloa*, *Hyparrhenia*, and *Leptochloa*. Blumea 19: 61–64.

Croton martinianus (Euphorbiaceae), a New Species from Mexico

Victor W. Steinmann
Rancho Santa Ana Botanic Garden, 1500 N. College Avenue,
Claremont, California 91711, U.S.A.

ABSTRACT. A new species of *Croton* (sect. *Geiseleria*) from western Mexico is described and illustrated. The relationship between this species and *C. cupulifer* McVaugh is discussed, and a key distinguishing these two species and *C. glandulosus* L. is provided.

The tropical deciduous forest flora of southeastern Sonora, Mexico, is diverse and still relatively little known. This area was first floristically treated by the late Howard Scott Gentry in his 1942 publication *Rio Mayo Plants*. During the past few years, the University of Arizona Herbarium has conducted a project to revise and update this work. Trips to inventory the area's plants have resulted in a number of collections of an interesting herbaceous *Croton*; one specimen from northern Sinaloa and two specimens from Jalisco have also been located. These collections cannot be referred to any known species and are here described as new.

Croton martinianus V. W. Steinmann, sp. nov. TYPE: Mexico. Sonora: Mpio. Alamos, Sierra de Alamos, N side of the range ca. 2 km SW of Alamos along the trail from El Chalatón to La Huerta, 27°00′N, 108°58′W, ca. 750 m, 31 Aug. 1996, *Steinmann 952* (holotype, ARIZ; isotypes, BM, DAV, IBUG, MEXU, MICH, MO, NY, RSA, USON). Figure 1.

Herba perennis vel fortasse annua usque ad 30 cm alta, erecta vel ascendens, stellato-pubescens; stipulae attenuato-subulatae; folia principalia alterna, longipetiolata, lamina ovata, dentato-serrata; folia superiora minora et saepe angustiora et lanceolata, opposita; racemus terminalis, floribus pistillatis (1–)4–8, staminatis usque ad 40; bracteae attenuato-subulatae; florum staminatorum petala alba, stamina 10–11; flores pistillati apetali, sepalis viridibus, inaequalibus, oblanceolatis, obovatis, vel spathulatis, ovaria subglobosa, stellato-villosa, styli 3, bipartiti; capsulae subglobosae; semina oblonga, nitida, caruncula-ta.

Crotone cupulifero affinis, a quo differt bracteis longis et ovario stellato-villoso.

Species in honorum Paul S. Martin (1928–).

Monoecious perennial herbs (but flowering in the first year) to 30 cm high, erect to ascending, stellate-pubescent throughout; from a narrow taproot reaching 6 mm diam.; stems little branched below, often diffusely branched above; lower internodes to 6.5 cm long, decreasing in length above; stipules linear-subulate to 5.3 mm long, usually terminated by stellate trichomes; lower leaves alternate, on petioles (0.6–)1.1–3.8 cm long, with a pair of slender stipitate cupuliform petiolar glands 0.1–0.3 mm diam. on the sides of the petioles just below the point of attachment with the lamina, the lamina ovate, palminerved with 3–5 prominent veins, rounded at the base, serrate-dentate, generally acute at the apex, 1.6–4.7 cm long, 1.4–3.5 cm wide, densely hoary canescent to green and sparsely pubescent, the trichomes stellate with rays to 0.6 mm long; upper leaves nearly sessile or on short petioles, serrate-dentate, (1.0–)2.0–3.4 mm long, mostly opposite or below the flowering branches appearing whorled; inflorescences exceeding the subtending leaves, terminal, racemose, 2.5–7.0 cm long, with (1–)4–8 pistillate flowers and up to ca. 40 staminate flowers; bracts linear-subulate, 1.1–2.5 mm long, subtended at the base by clusters of orange-brown glands ca. 0.1 mm long, tips of the bracts with 1–5 straight bristle-like hairs; staminate flowers on pedicels 1.1–2.0 mm long, calyx 1.7–2.2 mm long, the sepals united toward the base, their free lobes deltoid, 1.2–1.7 mm long, petals white, narrowly obovate-elliptic, 1.7–2.2 mm long, 0.9–1.0 mm wide, villous especially along the margins and toward the base; small ovate glands ca. 0.2 mm long opposite the sepals and alternating with the petals; receptacle densely villous within; stamens 10–11, filaments glabrous, 1.0–1.4 mm long, anthers ca. 0.5 mm long, ca. 0.3 mm wide, elliptic, basifixed and inflexed in the bud; pistillate flowers apetalous, on pedicels 0.6–2.1 mm long, the sepals 3.2–4.1 mm long, 1.5–2.9 mm wide, oblanceolate to spatulate, green and somewhat foliaceous, unequal, the proximal generally smaller and narrower, occasionally small linear-filiform appendages to 0.8 mm long present between the sepals; ovary nearly globose, stellate-pubescent, appearing villous, the rays of the trichomes to 1.9 mm long; styles 3, 1.7–2.0 mm long, biparted, pa-

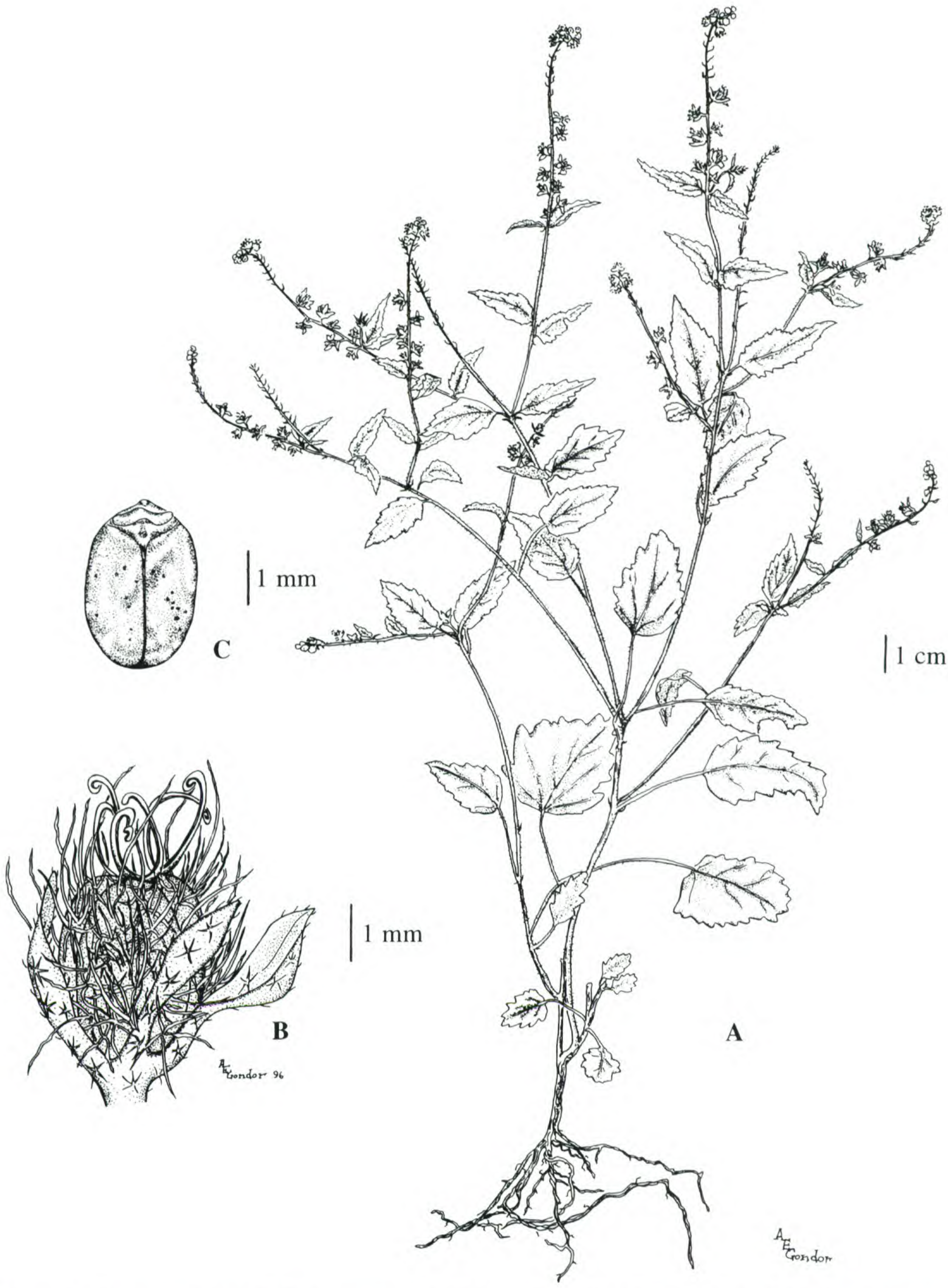


Figure 1. *Croton martinianus* V. W. Steinmann. —A. Habit. —B. Pistillate flower. —C. Seed. All from *Steinmann 93-309*.

pillate and often beset with stellate trichomes; capsule nearly globose 3.6–3.9 mm diam.; columella 2.6–3.0 mm long; seeds oblong, 3.0–3.3 mm long, 2.0–2.2 mm wide, dorsoventrally compressed, shallowly foveolate, blackish brown to mottled black-gray, shiny, carunculate; caruncle narrowly and transversely elliptic.

Phenology. Flowering and fruiting overlap broadly. Reproductive plants have been collected in March and June to September.

Distribution and habitat. Southeastern Sonora, northern Sinaloa, and northern Jalisco, 150–1200 m. On the north side of the Sierra de Alamos, this species is frequent along the trail from El Chalatón to La Huerta, where the plants mostly occur in rocky, red-orange soil on relatively dry hillsides in tropical deciduous forest and lower oak woodland.

Etymology. The specific epithet honors the well-known paleontologist Paul S. Martin, an avid student of the flora of Sonora and Chihuahua and a treasured friend.

Following the sectional delimitations of *Croton* as circumscribed by Webster (1993), *C. martinianus* belongs to section *Geiseleria* (Klotzsch) Baillon, where it is most similar to *C. cupulifer* McVaugh, a species of western Mexico known from the states of Colima and Jalisco. Both of these taxa possess coarsely toothed leaves that are quite diverse in form; the lower ones are usually alternate, long-petiolate, and relatively large, while those associated with the inflorescence are opposite to whorled, subsessile, smaller, and narrower. The two species also have attenuate-subulate stipules, nearly identical cupuliform petiolar glands, and unequal pistillate sepals that are somewhat foliaceous. In the protologue of *C. cupulifer*, McVaugh (1961: 163) mentioned that 1 or more extra calyx lobes often develop in the pistillate flowers. Although this unusual characteristic has not been observed in *C. martinianus*, linear-filiform appendages are rarely present between the sepals, and these may represent highly reduced sepals. The salient distinguishing features of these two species are given in the key.

The leaves of *Croton martinianus* vary from densely hoary-canescent to green and sparsely pubescent. This character appears environmentally influenced, with the hoary-canescent leaves occurring in drier periods of the year.

Croton martinianus also bears a resemblance to *C. glandulosus* L., to which the first collections were initially referred. The following key will separate *C. martinianus* from *C. glandulosus* and *C. cupulifer*:

1a. Pistillate flowers in a tight cluster and appearing fasciculate; inflorescence generally less than 2 cm long and not exceeding the subtending leaves . . . . . *C. glandulosus*

1b. Pistillate flowers moderately spaced and arranged in a raceme; inflorescence generally 3–10 cm long and exceeding the subtending leaves.

2a. Plants perennial herbs, sometimes appearing annual; staminate bracts 1.1–2.5 mm long; pubescence of the ovary appearing villous, at least some of the rays of the stellate trichomes greater than 1 mm long . . . . . *C. martinianus*

2b. Plants shrubs or less frequently perennial herbs; staminate bracts 0.6 mm or less; pubescence of the ovary appearing puberulent, the rays of the stellate trichomes less than 0.3 mm long . . . . . *C. cupulifer*

Paratypes. MEXICO. **Jalisco:** 1 km a NE de San Cristóbal de la Barranca, 900 m, 13 Feb. 1993, *Lomelín 2010* (DAV); San Cristóbal de la Barranca, 12 km al S de la población, 1200 m, 26 Aug. 1987, *Ornelas & Cervantes 1199* (HUMO). **Sinaloa:** Mpio. Salvador Alvarado, cerros al N de Terrero, 150 m, 12 Aug. 1988, *Bojórquez 688* (MEXU). **Sonora:** 1.25 mi. NW of Alamos in El Rincón area, 1350 ft., 3 Sep. 1973, *Fish 82* (UC); ca. 2 mi. NE of Alamos along road to Cuchuhuari, 27°01′N, 108°54′W, 410 m, 19 Aug. 1994, *Fishbein 1892* (ARIZ); Sierra de Alamos, 22 July 1989, *Martin s.n.* (ARIZ); 8 mi. W of Alamos, road from Minas Nuevas to Aduana, 24 June 1984, *Starr 779* (ARIZ, DAV); same locality as the type, 27 Aug. 1993, *Steinmann 93-309* (ARIZ, DAV, MEXU); Arroyo Gochico, ca. 10 km (by air) E of San Bernardo, S-facing slope above arroyo, along the trail from San Bernardo to Gochico Nuevo, in the vicinity of 27°24′N, 108°44′30″W, 750 m, 15 Mar. 1995, *Steinmann 606* (ARIZ, DAV, F, HUMO, MEXU, MO, NY, RSA, UCR); ca. 5 km (by road) N of Güirocoba along the road to Choquincahui, in the vicinity of 26°57′N, 108°41′30″W, ca. 500 m, 13 Mar. 1995, *Steinmann 613* (ARIZ); Sierra de Alamos, El Rincón Viejo, Arroyo El Aguaje, ca. 3.4 km (by air) N of Alamos, 27°03′55″N, 108°56′W, 480–520 m, 23 Sep. 1993, *Van Devender 93-1066* (ARIZ).

Acknowledgments. I thank Paul S. Martin, Thomas R. Van Devender, and Rebecca K. Wilson for encouragement and support. Rupert C. Barneby kindly assisted with the Latin diagnosis and description. Marshall R. Crosby, Mark Fishbein, Gordon McPherson, and Grady L. Webster provided many useful comments about the manuscript. Anne Gondor rendered the illustration. For the privilege of access to their collections, I am indebted to the curators and staffs at ARIZ, DAV, HUMO, MEXU, and UC.

Literature Cited

Gentry, H. S. 1942. Rio Mayo Plants. Carnegie Institution of Washington Publication 527. Washington, D.C.

McVaugh, R. 1961. Euphorbiaceae novae Novo-Galicianae. Brittonia 13: 145–205.

Webster, G. L. 1993. A provisional synopsis of the sections of the genus *Croton* (Euphorbiaceae). Taxon 42: 793–823.

Acanthosyris annonagustata (Santalaceae), a New Species from Eastern Ecuador

Carmen Ulloa Ulloa and Peter Møller Jørgensen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. A new species, *Acanthosyris annonagustata* C. Ulloa & P. Jørgensen, from Napo, Ecuador, is described and illustrated. This species is characterized by its golden brown puberulent inflorescence and fruit. The plant is used in local medicine, and the fruits taste like *Annona* and are eaten by monkeys. In Ecuador, *Acanthosyris* is also represented by *A. glabrata* (Stapf) Stauffer from the dry western forests, a tree that we are also reporting for the first time from Peru.

RESUMEN. Se describe e ilustra la nueva especie *Acanthosyris annonagustata* C. Ulloa & P. Jørgensen (Santalaceae) de la provincia de Napo, Ecuador, que se caracteriza por tener las inflorescencias y frutos pardo-dorado puberulentos. La planta es medicinal, los frutos tienen sabor a *Annona* y son comidos por monos. En el Ecuador *Acanthosyris* también está representado por *A. glabrata* (Stapf) Stauffer, un árbol de los bosques secos occidentales que además se cita por primera vez para Perú.

The genus *Acanthosyris* (Martius & Eichler) Grisebach in Ecuador was known only from the type collection of *Acanthosyris glabrata* (Stapf) Stauffer made by Baron von Eggers at "Hacienda El Recreo," province of Manabí in 1893. The "Hacienda El Recreo" is the type locality of several species, located north of the town of Bahía de Caráquez, between San Vicente and Canoas, and in 1977 only an abandoned house was left by the beach (H. H. Iltis, pers. comm.). A century after the publication of this species in the genus *Cervantesia* Ruiz & Pavón, we saw the isotype at the U.S. National Herbarium and could therefore identify several recent collections from Ecuador and northern Peru, most of this material being misidentified as *Ximenia* (Olacaceae). *Acanthosyris glabrata* is also known from two Peruvian collections, *Lao 5153* (MO) and *Vargas 9* (F, MO) from the department of Tumbes. During preparation of the Santalaceae for the *Flora of Ecuador,* we have studied specimens from Guayas, Manabí, and Loja provinces. *Acanthosyris glabrata* is also known from the department of Atlántico in northern Colombia. This species grows in dry forests from near sea level to 500 m elevation. Nee (1996) published a key of the woody Santalaceae for South America and described *A. asipapote* M. Nee from Santa Cruz, Bolivia. Recent collections of an edible tree from the Amazonian province of Napo, Ecuador, have revealed a new species of *Acanthosyris,* making six the total number of species presently known in the genus. *Acanthosyris* is a South American genus of more or less spiny shrubs and trees, with edible, drupaceous fruits, distributed from Colombia to northern Argentina, Uruguay, Paraguay, and Brazil. In Ecuador it is represented by two species, which can be separated by the following key:

1a. Fruit ca. 2 cm long, glabrous, smooth; flowers whitish gray velutinous, rachis whitish gray villous; leaves ovate; young leaves sparsely villose on the midrib and petiole below; old twigs with exfoliating bark; Pacific dry forest . . . . *A. glabrata*

1b. Fruit 2.9–4 cm long, densely puberulent, rugulose; flowers and rachis golden brown puberulent; leaves elliptic; young leaves glabrous or rarely with a few minute hairs on the midrib and petiole below; old twigs with striate bark; Amazonian rainforest . . . . . *A. annonagustata*

Acanthosyris annonagustata C. Ulloa & P. Jørgensen, sp. nov. TYPE: Ecuador. Napo: Parque Nacional Yasuní, carretera y oleoducto de Maxus en construcción, km 20, 250 m, 28–30 July 1993 (fr), *M. Aulestia & G. Grefa 232* (holotype, QCNE; isotypes, AAU, GB, MO, US). Figure 1.

Arbores 30 m altae, spinosae. Folia elliptica, 5–15 cm longa, 2.1–6.8 cm lata, glabra, petiolis 4–9 mm longis. Inflorescentia spicata 2.1–6.8 cm longa. Flores extus trichomatibus fulvis dense puberuli, tepalis 5(6), 2.0–2.5 mm longis, staminibus 5(6), nectario 5(6)-lobato, lobis 1.5–1.8 mm longis. Fructus drupaceus, 2.9–4 cm longus, trichomatibus fulvis dense puberulus.

Tree to 30 m tall, 30–45 cm diam.; old branches with light brown or whitish gray, thinly striate bark, spiny; twigs drying dark brown, finely striate, and angulate, spiny; spines one or two per leafy twig, 4–10.1 mm long, axillary to a leaf and subtending an axillary bud. Leaf blades elliptic, 5–15 × 2.1–6.8 cm, acute to acuminate at apex, acute to atten-

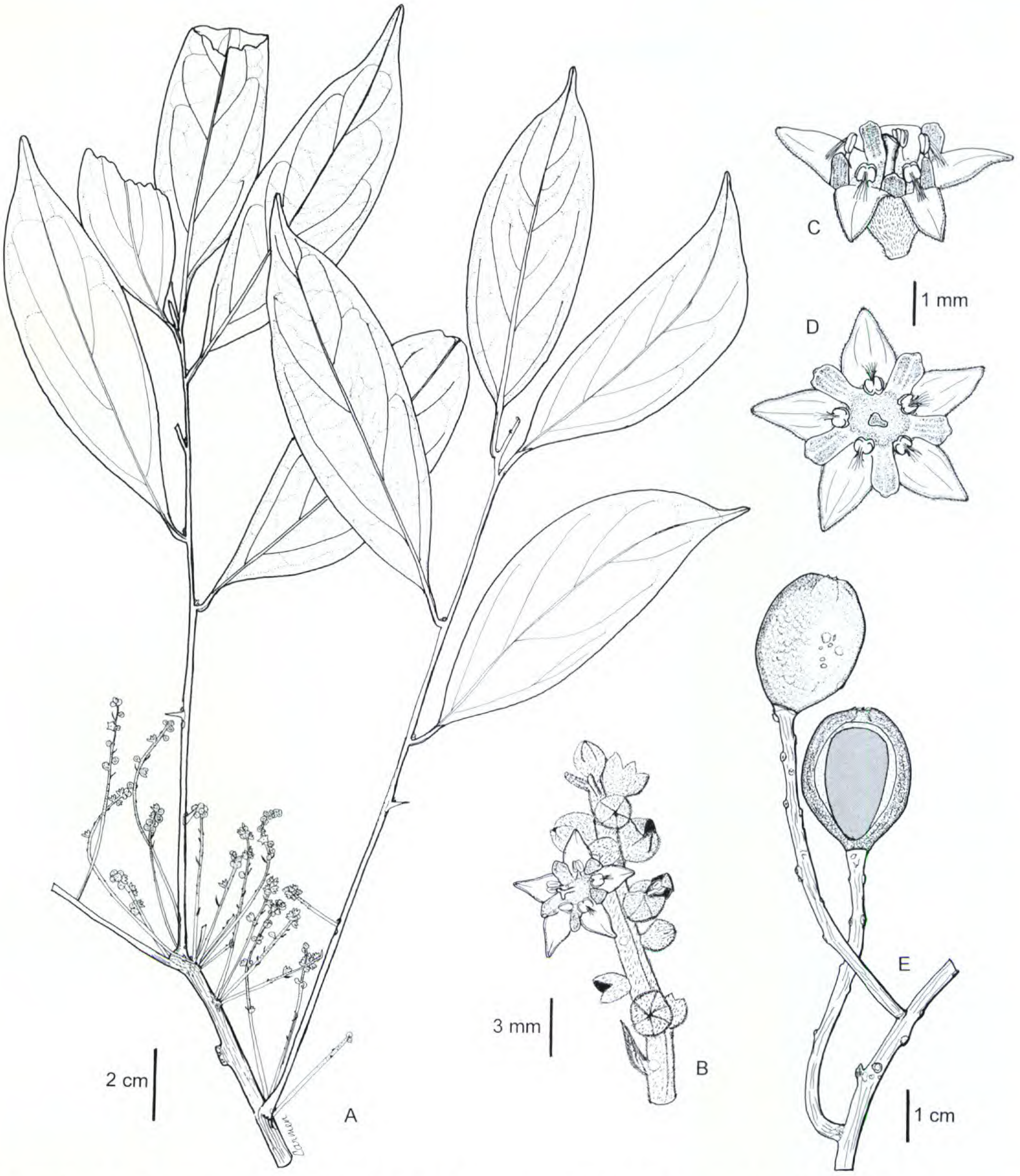


Figure 1. *Acanthosyris annonagustata* C. Ulloa & P. Jørgensen. —A. Habit, flowering branch. —B. Apical portion of inflorescence. —C. Open bud. —D. Open flower. —E. Fruits, with longitudinal section. (A–D, based on *Aulestia et al. 1318*; E, based on *Aulestia & Grefa 232* and *Dik 522*.)

uate and slightly decurrent at base, margin flat to slightly revolute, papery when young, chartaceous when mature, glabrous with a few scattered hairs on the midnerve and petiole when young, soon glabrescent, above drying brown or olive, lustrous, below dull, midnerve impressed or flat above, raised and rounded below, secondary lateral nerves 4–7 per side, raised on both surfaces, tertiary venation reticulate, visible on both surfaces; petiole 4–9 mm long, flat to slightly canaliculate above, rounded below. Several spikes generally clustered at the base of young branches, or 1 or 2 below the leaves, 2.1–6.8 cm long, rachis densely golden brown puberulent in the upper half, glabrescent, dark brown and lustrous toward the base, 14–24-flowered, bracteate; bracts 1.5–2.5 mm long, sparsely to densely puberulent. Flowers campanulate, greenish cream, 5–7 mm diam., densely covered with minute golden

brown hairs on the outside; the tepal lobes 5(6), triangular, 2.0–2.5 mm long, glabrous within except for a central tuft of long hairs with sticky tips that adhere to the adaxial side of the stamens; stamens 5(6), opposite the tepals, 1.3–1.5 mm long, inserted near the base of the tepals, filaments flat, tapered toward the anther; nectary with 5(6) oblong lobes alternating with the tepals, 1.5–1.8 mm long, minutely puberulent; style 1.2–1.8 mm long, stigma trilobed. Infructescence rachis to 8.5 × 0.4 cm, glabrescent, striate; fruit drupaceous, obovoid to ellipsoid, 2.9–4 × 2.2–2.8 cm, yellow or orange-yellow, crowned by the remains of the tepals, nectary and style, which form a depressed scar ca. 3 mm diam., the exocarp woody, 3–4 mm thick, the outer surface minutely granulose, densely covered with golden brown hairs ca. 0.25 mm long, mesocarp white or light orange; seed single, obovoid, to 3.2 × 1.6–1.8 cm.

Etymology, common names, and uses. According to *Dik 522* the fruit is very sweet with a taste of "Guanábana" (*Annona muricata* L.), hence the name of this new species. The Huaorani Amerindians call it "Aguencatue" (*Aulestia & Gonti 2053*) or "Oreclamohue" (*Aulestia et al. 1318*) and prepare a tea to eliminate intestinal worms (*Aulestia et al. 1318*).

Distribution, habitat, and dispersal. This species has been collected in eastern Ecuador along a road opened by an oil company in the Amazon rainforest at the Yasuní National Park and Huaorani Ethnic Reserve, Napo province, at ca. 250 m elevation. Material in flower has been collected in December and in fruit in March, July, September, and December. This new species is common in the area where spider (*Ateles*) and woolly (*Lagothrix*) monkeys feed on the fruits and presumably are the principal seed dispersal agent (D. Neill, pers. comm.). According to Dawson (1944), fruits of the Argentinean species of *Acanthosyris* are eaten by mammals and birds, but seed dispersal has not been verified. Fruits of *A. glabrata* are relished by agouti (*Dasyprocta*) (Smith, 1950), and the fruits of *A. asipapote* are generally eaten by wild animals (Nee, 1996). As this new species has been reported having a tasty fruit, presumably other large Amazonian frugivores consume and disperse it. Galo Tipaz, an Ecuadorian botanist, and his assistants germinated seeds as part of the revegetation of the Maxus pipeline road, and the plants were established in the revegetated areas of that road, where at least some of them survived (D. Neill, pers. comm.). There is no documentation of hemiparasitism in this species, although it is probably a root hemiparasite, as are other species in the genus (Barroso, 1968) and the family (see Kuijt, 1969).

Acanthosyris annonagustata is characterized by its elliptic leaves and golden brown puberulent inflorescence and fruits. It is the only species that has pubescent fruits when mature. These are of medium size in the genus: *A. asipapote* and *A. paulo-alvinii* G. M. Barroso from Brazil have fruits almost twice as large, while the other species have fruits generally less than 2.5 cm long. The inflorescence and flowers are similar to those of *A. glabrata* and *A. asipapote*, but the indument of the rachis, bracts, and flowers is golden brown in the new species, versus whitish gray in *A. glabrata*, and ferrugineous (bracts) and pale (rachis and flowers) on *A. asipapote*. Furthermore, some of the flowers of *A. annonagustata* have six tepals, stamens, and nectary lobes, while only five have been reported for the other species in the genus. The leaves are elliptic in *A. annonagustata*, as in *A. paulo-alvinii*. This is the only species in the genus that grows in tropical rainforest and has fruits known to be eaten by monkeys.

Paratypes. ECUADOR. **Napo:** Parque Nacional Yasuní, carretera y oleoducto de Maxus en construcción km 40, Parcela permanente No.10, 235 m, 10 Dec. 1994 (fr), *M. Aulestia 2987* (QCNE); km 46, 244 m, 17 Sep. 1993 (fr), *A. Dik 522* (COL, F, MO, QCNE, USM); km 10–12, 250 m, 10 July 1993 (fr), *G. Tipaz 2724* (QCNE); Reserva étnica Huaorani, carretera y oleoducto de Maxus en construcción km 67–69, 250 m, 1–3 Dec. 1993 (fl), *M. Aulestia, N. Andi & E. Nenquerei 1318* (AAU, COL, GB, MO, QCA, QCNE, US, USM); km 92–96, 250 m, 20 Mar. 1994 (fr), *M. Aulestia & O. Gonti 2053* (LPB, MO, NY, QCA, QCNE, S).

Acknowledgments. We thank Roy Gereau for correcting the Latin description, Henk van der Werff for revising the manuscript, David Neill and Hugh Iltis for sharing their observations with us, and Job Kuijt and Michael Nee for their review comments.

Literature Cited

Barroso, G. M. 1968. *Acanthosyris paulo-alvinii*—uma nova espécie de Santalaceae. Anais Soc. Bot. Brasil (XIX Congresso Nacional de Botânica 1968): 107–109.

Dawson, G. 1944. Las Santaláceas argentinas. Revista Mus. La Plata, Secc. Bot. 4(23): 1–80.

Kuijt, J. 1969. The Biology of Parasitic Flowering Plants. Univ. California Press, Berkeley.

Nee, M. 1996. A new species of *Acanthosyris* (Santalaceae) from Bolivia and a key to the woody South American Santalaceae. Brittonia 48: 574–579.

Smith, A. C. 1950. A Colombian species of *Cervantesia* R. & P. Trop. Woods 51: 12–14.

A New Species of *Ceratozamia* (Zamiaceae) from Veracruz, Mexico

Mario Vázquez-Torres
Instituto de Investigaciones Biologicas, Universidad Veracruzana,
Apdo. Postal 294 Xalapa, Veracruz, 9100 Mexico

Andrew P. Vovides
Instituto de Ecología, A.C., Apdo. Postal 63, Xalapa, Veracruz, 91000 Mexico

ABSTRACT. *Ceratozamia morettii* is described from a cloud-forest environment in Veracruz, Mexico. The main morphological characters are illustrated, and comments on related species are made. The new species differs from others in the genus by the near prostrate habit, circinate vernation of the leaves, and wide leaflets with translucent venation. This taxon is apparently related to a group of species that are relatively small trunked, branched, produce few leaves, and have relatively small strobili. The non-sympatric species of the group also inhabit moist to very moist habitats, as in the case of *C. miqueliana*, *C. microstrobila*, and *C. mexicana* var. *robusta*.

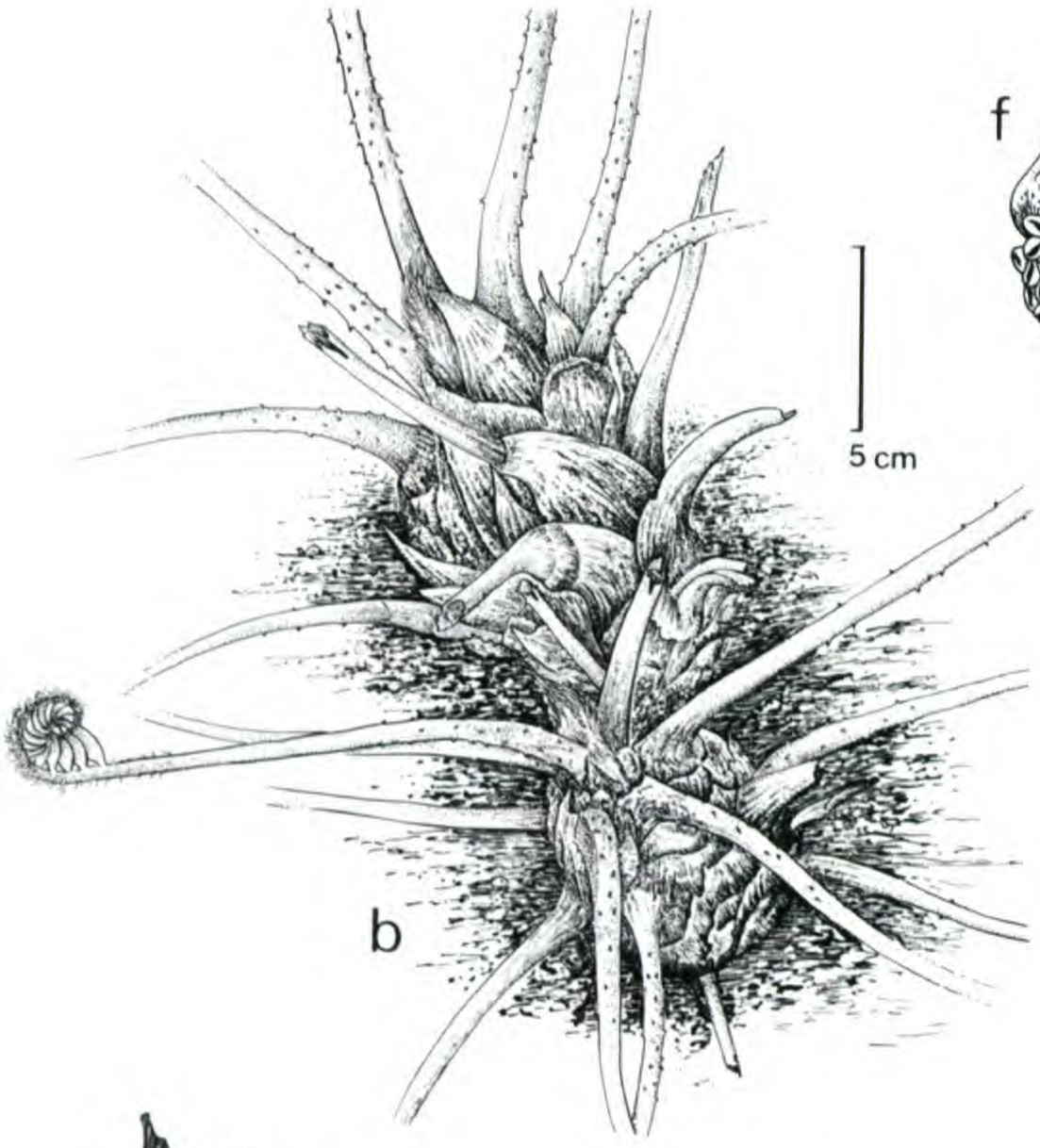
Ceratozamia morettii Vázquez-Torres & Vovides, sp. nov. TYPE: Mexico. Veracruz: 7 Jan. 1992, *M. Vázquez-Torres & H. Barney 4097* (holotype, CIB; isotypes, CIB, MEXU, XAL). Figure 1.

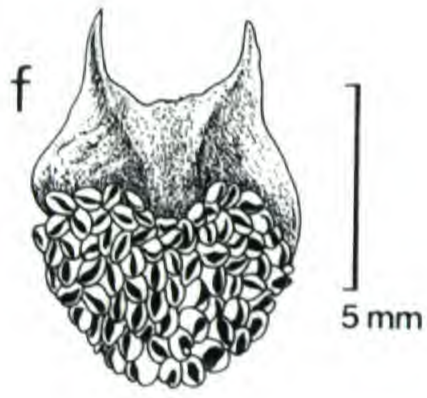
Truncus semihypogaeus, humilis ad 30 cm altus; *folia* vernata circinata, pauca, usque 10, glabra. *Foliola* subopposita vel alterna, 12–25 juga, remota, linearis vel falcata, translucida, tenuia, basicuneata.

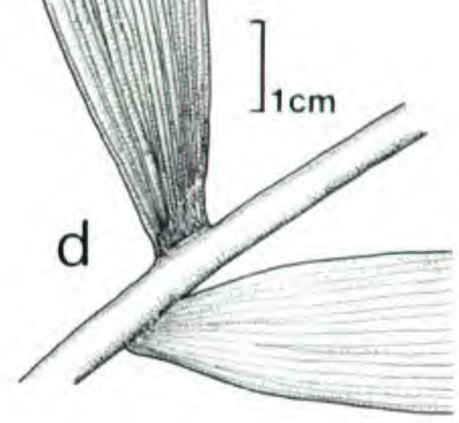
Plant palm-like, *trunk* erect to procumbent, short, globose to cylindrical, semihypogeous up to 30 cm long, 8 cm diam., typically with 1–4 branches covered with persistent cataphyll and leaf bases; *cataphylls* triangular, 2 cm wide at base, 2.6 cm long; *vernation* circinate; *leaves* light green, pubescent when juvenile, decurrent to prostrate forming an open crown with a maximum of 10(4–7) leaves per crown, 1–1.4 m long, 40–65 cm wide; *leaflets* 12–25 pairs, ovoid when immature, becoming linear to falcate upon maturity, chartaceous, venation parallel, translucid, pale yellow, dichotomous principally in the lower third of leaflet, 25–35 cm long at median position of leaf, distal portion unevenly sinuous, apex acute, base attenuate, 2.7–4.8 cm wide, petiole terete or subterete, 45–60 cm long, armed with short stout prickles; *microstrobilus* typically coniform, elongate, yellowish green, 10–15 cm long, 2.5–4 cm diam.; *peduncle* terete, 5–7 cm long, 1 cm diam., reddish brown tomentum; *microsporophylls* cuneate, 10–12 mm long, 8–9 mm wide, distal end with two erect to curved prominent coniform protuberances; *microsporangia* numerous, generally in sori of three covering ½ to ⅔ of abaxial surface, dehiscence longitudinal; *megastrobilus* coniform, green when juvenile turning brown at maturity, 12–16 cm long, 4.5–5 cm diam.; *peduncle* terete, dark brown tomentose, 5–7 cm long, 1 cm diam.; *megasporophylls* peltate, reddish brown, distal end almost hexagonal with two erect or curved corniform protuberances; *ovules* ovoid, two per megasporophyll; *seeds* irregularly ovoid without any defined faces, sarcotesta yellowish white when immature turning to gray brown, delicately papyraceous and transparent when mature, sclerotesta hard, light gray, 1.5–1.8 cm long, 1.2 cm diam.; *chromosome number* $2n = 16$.

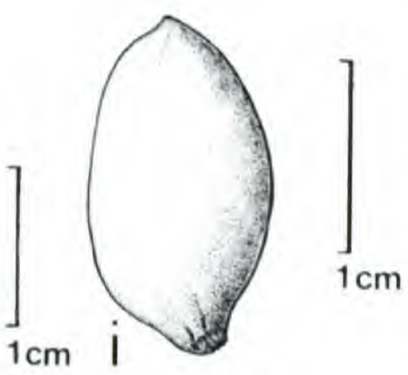
CHROMOSOMAL STUDIES

The chromosome number and karyotype of *Ceratozamia morettii* were determined from three established specimens held at the Jardin Botánico Fco. J. Clavijero (Botanic Garden of the Instituto de Ecología) under the accession numbers 81-397, 81-857, and 81-852; vouchers are deposited at XAL. The root tip mitosis technique used was that described by Vovides (1983), and the chromosome classification based on centromere position was that of Levan et al. (1964) modified by Schlarbaum and Tsuchiya (1984). The diploid idiogram (Fig. 2) was constructed by taking the average arm lengths of the best three metaphase cells examined (Fig. 3). Photomicrography was done on a Zeiss photomicroscope (Fomi III) equipped with phase contrast optics and planapochromatic objectives. Prints were made using Kodak bromide paper. Arm lengths, total chromosome length, chromosome index (short arm divided by long arm), and symmetry index (length of longest pair divided by length of shortest pair) were computed using the average arm lengths from the three metaphase cells (Table 1). The









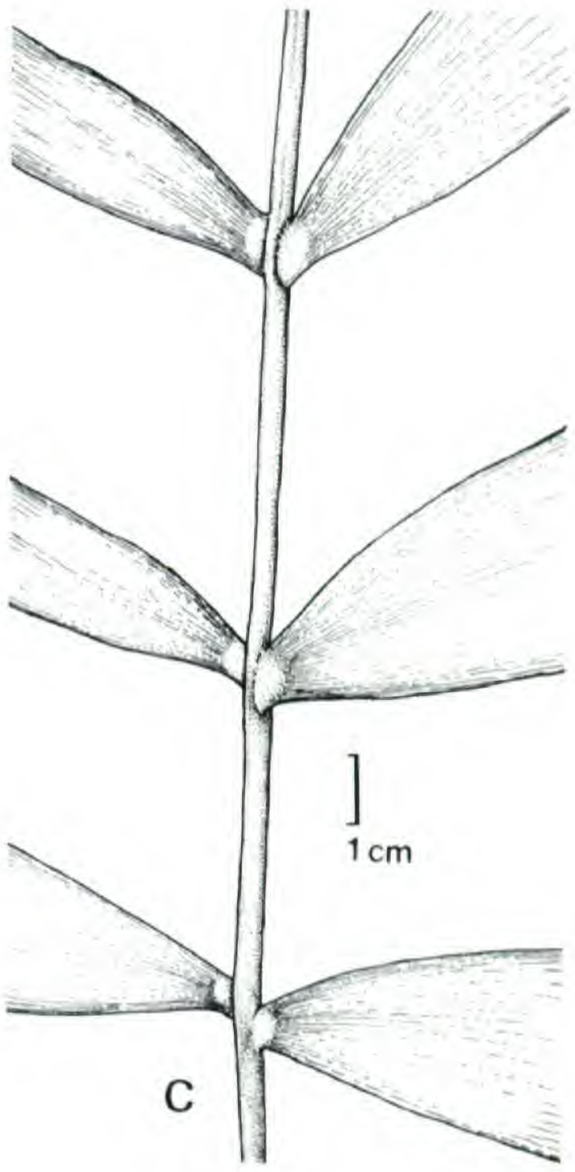


Figure 1. a–i, *Ceratozamia morettii* Vázquez-Torres & Vovides. —a. Habit of plant. —b. Circinate vernation of leaf, petiole, and trunk. —c. Leaflet articulations and rachis. —d. Detail of leaflet veins. —e. Non-expanded male strobilus. —f. Abaxial view of microsporophyll showing dehisced sporangia. —g. Female strobilus. —h. Megasporophyll with immature ovules. —i. Seed.

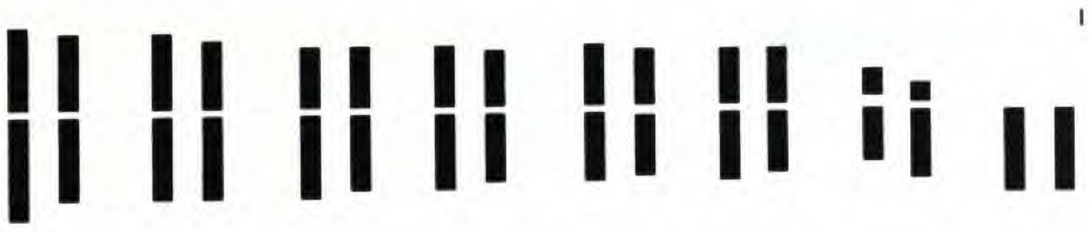


Figure 2. Diploid idiogram of *Ceratozamia morettii* ($2n = 16$), bar = 2 μm.

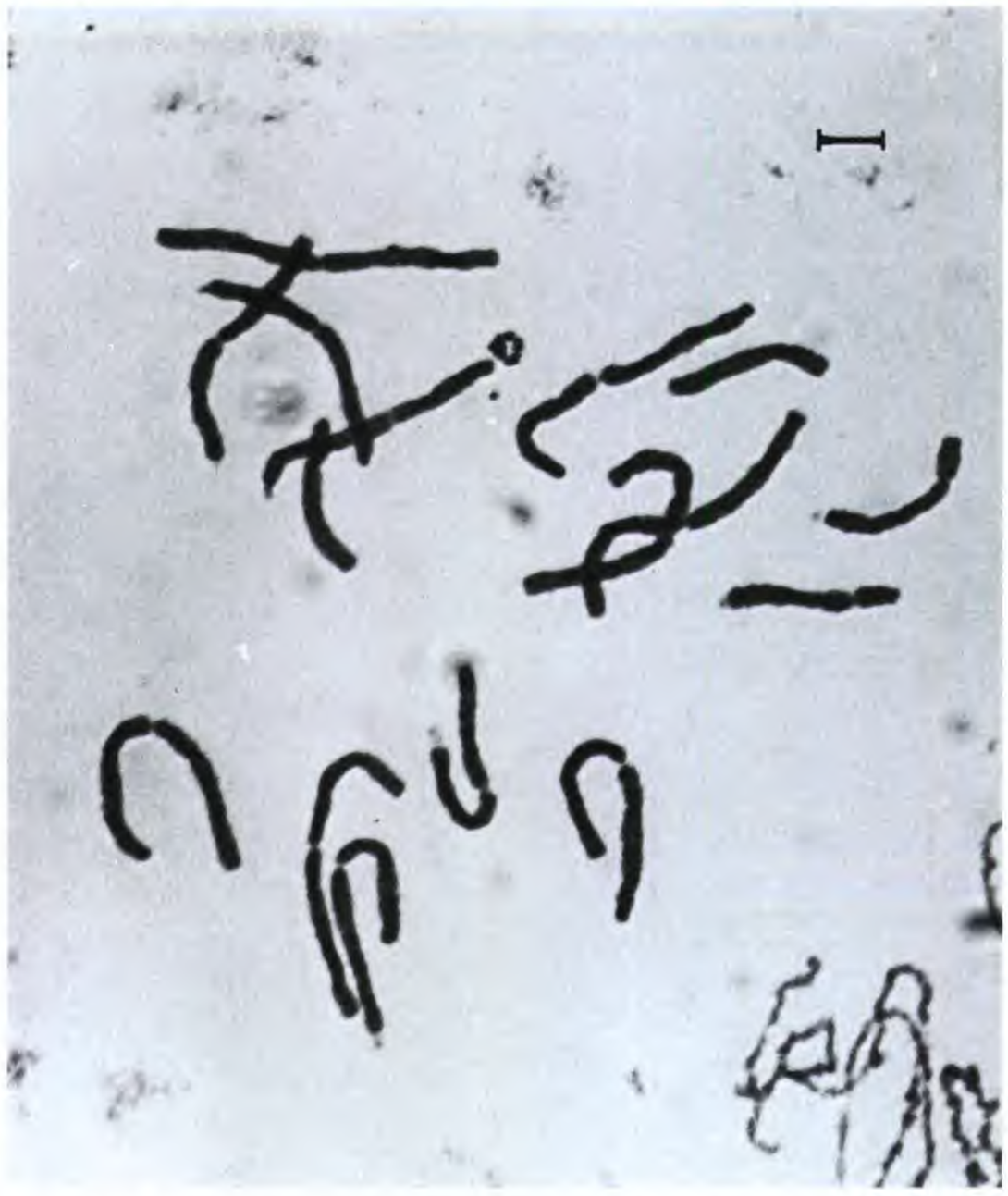


Figure 3. Mitotic metaphase cell of *Ceratozamia morettii*, bar = 4 μm.

karyotype shows 12 median region (m) chromosomes, 1 submedian (sm), 1 sub-terminal region (st) chromosome, and 2 terminal point (T) chromosomes. A maximum of 5 satellites were recorded but were not considered in the calculations.

Habitat

This cycad occurs in cloud forest on humus-rich grayish yellow clay soil of volcanic origin. The plants are found on steep 45–60° slopes or on vertical rocky walls of loose, weathered basalt, at an elevation of 1200 to 1400 m. The closest climatological station to this habitat has recorded an average temperature of 17.3°C and over 1900 mm annual precipitation.

Other vascular plants associated with the cycad in this vegetation type are typical of cloud-forest species distributed on the windward slopes of the Sierra Madre Oriental facing the Gulf of Mexico. These are: *Alnus jorullensis* Kunth, *Clethra mexicana* DC., *Dendropanax arboreus* (L.) Decaisne & Planchon, *Dicksonia gigantea* Maxon, *Ilex discolor* Hemsley, *Liquidambar macrophylla* Oersted, *Magnolia schiedeana* Schlechtendal, *Marattia laxa* Kunze, *Oreopanax capitatus* (Jacquin) Decaisne & Planchon, *Ostrya virginiana* (Miller) K. Koch, *Podocarpus guatemalensis* Standley, *Quercus germana* Chamisso & Schlechtendal, *Q. laurina* Humboldt & Bonpland, *Q. xalapensis* Humboldt & Bonpland,

Table 1. Karyotypic data at metaphase in root-tip mitosis of *Ceratozamia morettii* (mean of three metaphase cells).

Pair	Arm length (μm)		Total	Index (S/L)	r Value	Centromere position*
	Long (L)	Short (S)				
1	12.86	11.28	24.14	0.88	1.14	m
	11.13	10.17	21.30	0.91	1.09	m
2	11.07	9.94	21.01	0.90	1.11	m
	10.83	9.87	20.70	0.91	1.10	m
3	10.81	9.27	20.08	0.86	1.17	m
	10.48	9.22	19.70	0.88	1.14	m
4	10.21	9.21	19.42	0.90	1.11	m
	9.77	8.49	18.26	0.87	1.15	m
5	9.19	8.07	17.26	0.88	1.14	m
	9.22	7.69	16.91	0.83	1.20	m
6	9.17	7.51	16.68	0.82	1.22	m
	8.38	7.66	16.04	0.91	1.09	m
7	7.22	2.88	10.10	0.40	2.51	sm
	8.76	2.63	11.39	0.30	3.33	st
8	10.95	0.00	10.95	0.00	0.00	T
	10.77	0.00	10.77	0.00	0.00	T
	Total 274.71			Symmetry index = 0.48		

* m = median, msm = median-submedian, sm = submedian, st = subterminal, T = terminal. Average chromosome index = 0.70.

Turpinia insignis (Kunth) Tulasne, and *Ulmus mexicana* (Liebmann) Planchon.

Discussion

The specific epithet was chosen in recognition of the scientific contributions of Aldo Moretti in the field of cycad biology. Prof. Moretti is a researcher of the Orto Botanico of the University of Naples, Italy.

Ceratozamia morettii differs from the rest of its congeners by the circinate vernation of its leaves. Like *C. microstrobila*, *C. morettii* has few nearly prostrate leaves per crown and profuse branching of the trunk. *Ceratozamia morettii* belongs to the group of species having wide leaflets: i.e., *C. euryphyllidia* Vázquez-Torres, Sabato & Stevenson, *C. microstrobila* Vovides & Rees, *C. hildae* Landry & Wilson, *C. miqueliana* H. Wendland, *C. latifolia* Miquel, *C. mexicana* var. *robusta* (Miquel) Dyer, and *C. whitelockiana* Chemnick & Gregory. With the exception of *C. microstrobila*, *C. hildae*, and perhaps *C. mexicana* var. *robusta*, the other taxa are distributed south of the neovolcanic belt of Mexico in moist habitats.

The following key separates *Ceratozamia morettii* from other *Ceratozamia* species with wide leaflets.

Diagnostic Key

1a. Emerging leaves presenting circinate vernation, leaves spreading, leaflets ovoid when immature, linear, falcate to subfalcate, not greater than 5 cm wide . . . . . *C. morettii*
1b. Emerging leaves not presenting circinate vernation, leaves ascending or spreading, leaflets lanceolate, elliptic, obovate, or broadly oblanceolate.
  2a. Persistent leaf bases dark brown, not appressed to trunk.
    3a. Leaflets coriaceous.
      4a. Leaflets lanceolate, less than 4 cm wide . . . . . *C. mexicana* var. *robusta*
      4b. Leaflets not lanceolate.
        5a. Leaflets obovate to broadly oblanceolate, greater than 4 cm wide . . . . . *C. miqueliana*
        5b. Leaflets elliptic to oblanceolate, less than 4.5 cm wide . . . . . *C. latifolia*
    3b. Leaflets papyraceous.
      6a. Leaflets linear lanceolate, less than 4 cm wide . . . . . *C. whitelockiana*
      6b. Leaflets broadly oblanceolate, greater than 8 cm wide . . . . . *C. euryphyllidia*
  2b. Persistent leaf bases light brown, tightly appressed to trunk.
    7a. Leaflets pinnate, elliptic to lanceolate . . . . . *C. microstrobila*
    7b. Leaflets fasciculate, lanceolate . . *C. hildae*

The chromosome count and karyotype are consistent with that reported for the genus ($2n = 16$) by Marchant (1968), Vovides (1983, 1985), Vovides et al. (1993), and Moretti (1990). The karyotype of *C. morettii* (12m + 1sm + 1st + 2T) is nearly typical for the genus *Ceratozamia* (12m + 2sm + 2T) and appears to be stable within the genus (Vovides et al., 1993; Moretti, 1990). Satellite number and position appear to vary with cells observed and much care is needed in recording them. A maximum of five were recorded and many cells showed three.

The precise locality has been intentionally omitted to discourage indiscriminate commercial collecting of this endangered species, which could result in its extinction. The common names of this species are "tepetmaizte," or "tepemaizte" (forest maize), because of a similarity between the corncob and the cycad cones.

Acknowledgments. We thank Manuel Escamilla for the botanical illustration of this species. This research was partially funded by CONACyT projects No. 0063-N9106 and 1837P-N9507, I.E. Sistemática Vegetal project No. 904-14 and U.V. F641-M940.

Literature Cited

Levan, A., K. Fredga & A. A. Sandberg. 1964. Nomenclature for centromeric position on chromosomes. Hereditas 52: 201–220.

Marchant, C. J. 1968. Chromosome patterns and nuclear phenomena in the cycad families Stangeriaceae and Zamiaceae. Chromosoma (Berl.) 24: 100–134.

Moretti, A. 1990. Karyotypic data on north and central American Zamiaceae (Cycadales) and their phylogenetic implications. Amer. J. Bot. 77: 1016–1029.

Schlarbaum, S. E. & T. Tsuchiya. 1984. The chromosomes of *Cunninghamia konishi*, *C. lanceolata* and *Taiwania cryptomeroides* (Taxodiaceae). Pl. Syst. Evol. 145: 169–181.

Vovides, A. P. 1983. Systematic studies on the Mexican Zamiaceae I. Chromosome numbers and karyotypes. Amer. J. Bot. 70: 1002–1006.

———. 1985. Systematic studies on the Mexican Zamiaceae II. Additional notes on *Ceratozamia kuesteriana* from Tamaulipas, Mexico. Brittonia 37: 226–231.

———, M. Vázquez-Torres, B. Schutzman & C. G. Iglesias. 1993. A new species of *Ceratozamia* (Zamiaceae) from Querétaro and Hidalgo, Mexico. Novon 3: 502–506.

Trifolium jokerstii (Leguminosae, Papilionoideae), a New Species from Butte County, California

Michael A. Vincent
W. S. Turrell Herbarium, Department of Botany, Miami University, Oxford, Ohio 45056, U.S.A.

Randall Morgan
3500 Main St., Soquel, California 95073, U.S.A.

ABSTRACT. *Trifolium jokerstii* (Leguminosae, Papilionoideae), a new species from Butte County, California, is described and illustrated. It is morphologically similar to *T. barbigerum* and *T. grayi*, from which it differs in stipule shape, flower color, seed size, and lack of pubescence.

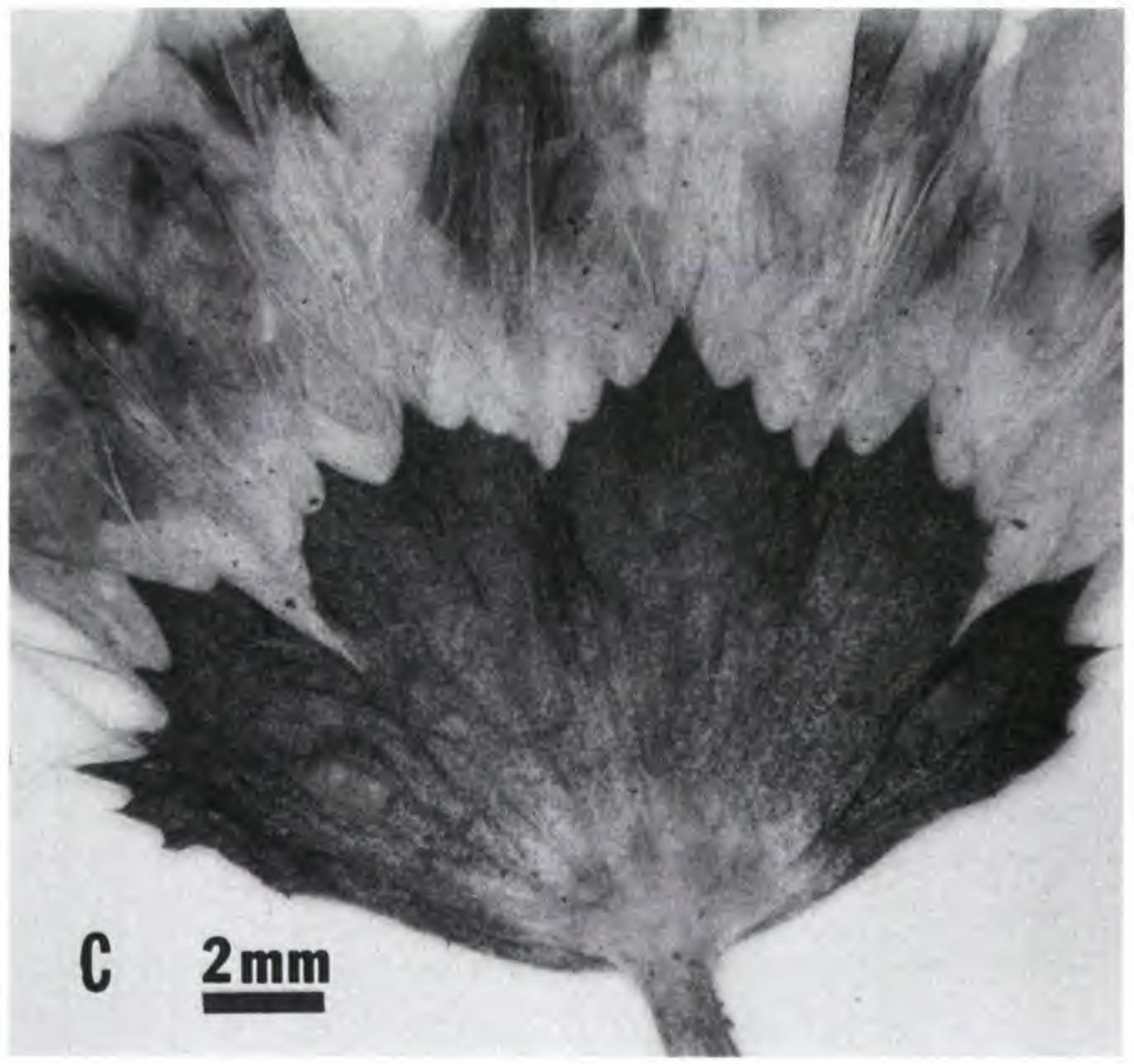
The genus *Trifolium* (Leguminosae, Papilionoideae) consists of approximately 240 species found in mainly temperate and montane regions, with areas of "Mediterranean" climate (the Mediterranean basin, California, and Chile) being considered centers of diversity in the genus (Zohary & Heller, 1984). In North America, 93 species are known (Kartesz, 1994), of which 64 are native and 29 are introductions. Isely (1993) recognized 45 species in California, 32 of which are native to the state; of these, 14 belong to section *Involucrarium*, a New World endemic section characterized by the presence of an involucre of fused bracts subtending the inflorescence.

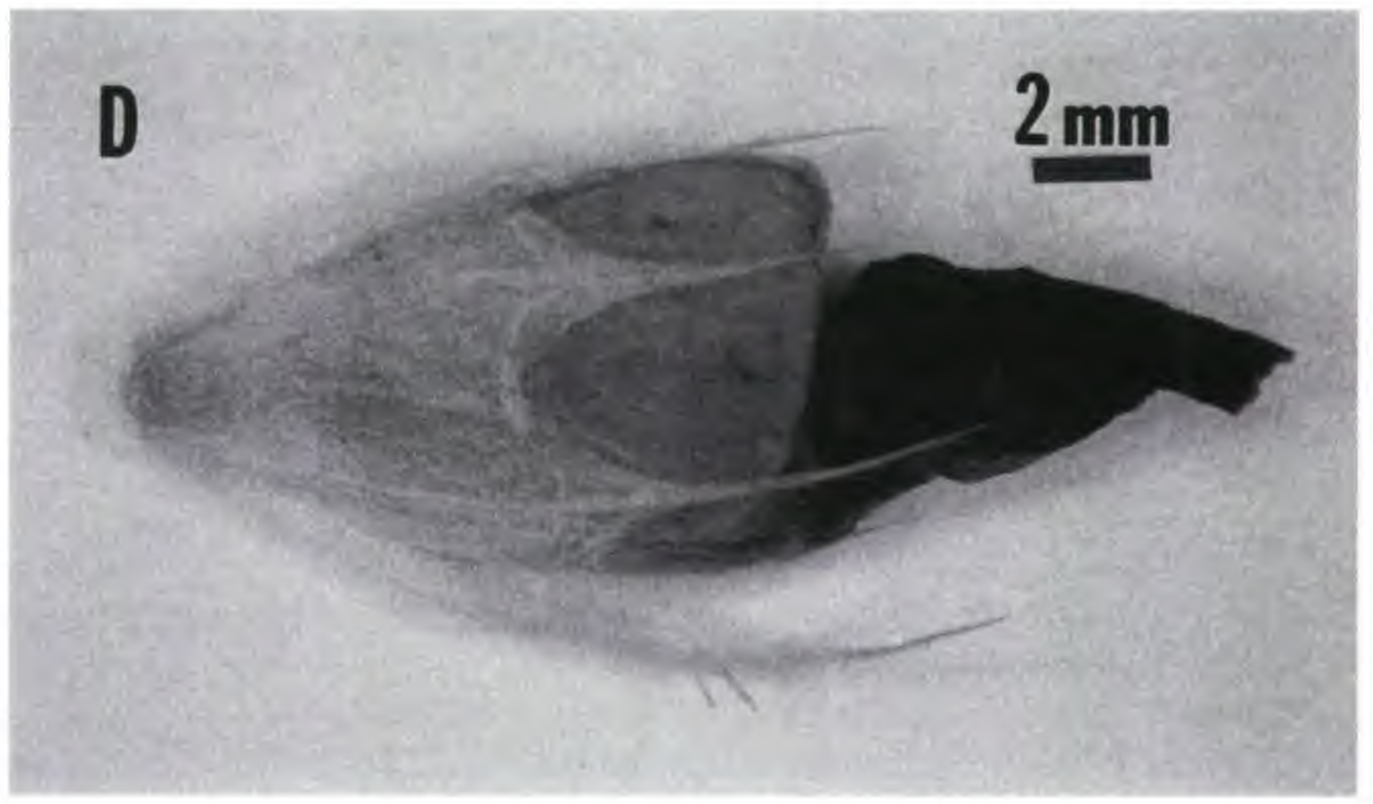
During the course of a revision of *Trifolium barbigerum* Torrey and related species of section *Involucrarium*, several specimens from the vicinity of North Table Mountain, Oroville, Butte County, in north-central California, were determined to represent an undescribed species. A single collection was examined by Isely and mentioned in his treatment of the genus for the *Jepson Manual* as a yellow-flowered variant of *Trifolium barbigerum* var. *andrewsii* A. Gray (Isely, 1993). The new species was also mentioned by Oswald and Ahart (1994) as possibly the same variety, with a comment that the plants might deserve taxonomic recognition. No collections of this taxon were mentioned by McDermott (1910) or Zohary and Heller (1984) in their monographs of the genus. The species is significantly different from both *T. barbigerum* and *T. grayi* Lojacono (*T. barbigerum* var. *andrewsii* A. Gray) and is described here as new.

Trifolium jokerstii Vincent & R. Morgan, sp. nov. TYPE: U.S.A. California: Butte County, North Table Mountain, N of Oroville, 29 Mar. 1996, *M. A. Vincent 7227, Rhode & Snowden* (holotype, MU 177695; isotypes, F, ISC, MO, NY, RSA, UC, US). Figure 1.

Trifolium annuum, caulis erectis vel ascendenti et simplico vel ramoso, glabro; stipulis ovatis, serratis, persistentibus; foliolis ellipticis vel obovatis, serrulatis; capitulis semiglobosis; pedunculis foliis longioribus; involucris lobatis; lobis ovatis, dentatis; calycibus campanulatis, pubescentibus, tenuis; lobis simplicibus subulatis, plumosis; corollis luteis ad sulphureas. Affinis *T. barbigero* Torrey et *T. grayi* Lojacono; ab utroque caulibus et foliis glabris, stipulis ovatis, serratis, corollis luteis ad sulphureas, et seminibus 3.1–3.4 mm longis differt.

Erect-ascending annual with simple to branched glabrous stems to 20 cm, from a fibrous taproot. Stipules thin, pale to green, 8–13(–20) × 7–10 mm, rounded to acute and serrate at apex, persistent, adnate to the petiole, distinct or sometimes basally fused into a cylinder for ⅔ their length. Leaves trifoliolate, petioles to 90 mm, glabrous. Leaflets sessile, glabrous, serrulate to rarely nearly lobed, elliptic to obovate, (5–)8–17(–32) × (4–)6–8(–15) mm, with or without a prominent white to dark purple chevron. Inflorescence involucrate, subglobose, 10–30-flowered, 12–30 mm wide, peduncle longer than the leaves; involucre wide-campanulate to nearly flat, (13–)15–17(–22) mm wide, glabrous, lobed, the lobes rounded, toothed. Calyx 7–9 mm long, expanding in fruit, tube membranous, sparingly pubescent, campanulate, 5-nerved, oblique; teeth plumose, nearly as long as to slightly longer than tube, subulate-setaceous, the upper shorter than the lower, simple, lateral teeth simple to bifid, lower tooth bifid to trifid. Corolla 10–15 mm long, golden-yellow to sulphur-yellow; standard broadly ovate, inflated in fruit with a constricted throat above the mouth of the calyx; wings auriculate, longer than keel; keel with or without a purple spot on each side. Ovary glabrous, 4–5 mm





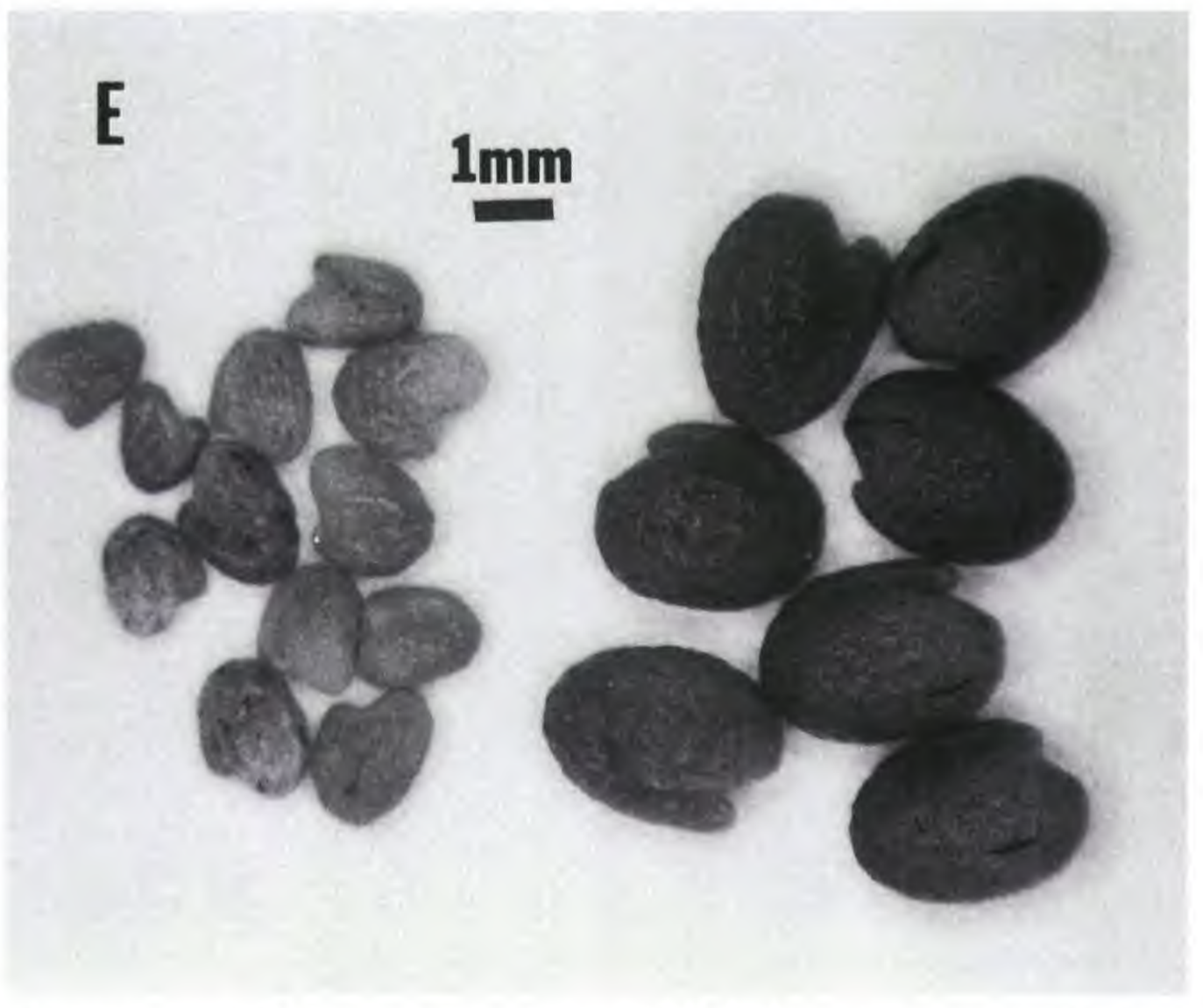


Figure 1. *Trifolium jokerstii* Vincent & R. Morgan. —A. Stipules (from *Ahart 7569 & Cunningham*). —B. Leaflet showing teeth and chevron (from the holotype). —C. Folded involucre, showing rounded, toothed lobes (from the holotype). —D. Inflated fruiting calyx and corolla (from *Morgan 2566c*). —E. Field-collected seeds of *Trifolium jokerstii* (right), and *T. grayi* (left), showing size differences.

long, ovules 2. Fruit 3.3–3.5 × 2.0–2.2 mm, stipitate, ovoid, (1–)2-seeded. Seeds 3.1–3.4 × 2.3–2.7 mm, dark brown, somewhat rough. Flowering March–May.

Trifolium jokerstii has affinities with *T. barbigerum* and *T. grayi*. It differs from the former in the larger size of all parts. It can be distinguished from both species by flower color, lack of pubescence on the stem and foliage, stipule shape, and seed traits. Flowers of *T. barbigerum* and *T. grayi* are lavender to purple with white to cream tips, or rarely all white. Stipules of *T. grayi* are acute to attenuate at the apex, with very large, jagged teeth, while stipules of *T. jokerstii* are rounded to slightly acute, with smaller teeth. Seeds of *T. grayi* measure 1.6–2.0 × 1.4–1.5 mm and are pale brown and mottled, while those of *T. jokerstii* are much larger (there are no intermediates) and are dark brown. Petioles of the cotyledons of *T. jokerstii* are from 13 to 25 mm long, while those of the cotyledons of *T. grayi* are 3–10 mm long.

The two known populations of *Trifolium jokerstii* are in Butte County, north of Oroville, and are at least 100 miles from the closest known population of *T. grayi*.

Allozyme banding patterns (Vincent, in prep.) are vastly different in *T. jokerstii* from those of both *T. barbigerum* and *T. grayi*, and bear out the distinctness of this species.

The new species is named in honor of the late James D. Jokerst [1956–1995 (Beedy & Preston, 1996)], who collected the earliest known specimen of the clover and published a flora of North Table Mountain (Jokerst, 1983). The common name "Butte County Golden Clover" was coined for the taxon by Oswald and Ahart (1994).

Paratypes. U.S.A. **California:** Butte County, North Table Mountain, N of Oroville, 2 Apr. 1995, *L. Ahart 7569 & Cunningham* (CHSC, MU), 30 May 1995, *L. Ahart 7583* (CHSC), 29 Mar. 1996, *M. A. Vincent 7205, Rhode & Snowden* (GH, ISC, MO, MU, RSA), *7215* (GH, ISC, MU, RSA, UC), *7219* (MU), *7240* (MU); along Cottonwood Road, N of Oroville, 7 Apr. 1989, *L. Ahart 6202* (CAS, CHSC, MO, R. Morgan personal herbarium, UC), 29 Mar. 1985, *J. D. Jokerst 2186* (ISC), 29 Mar. 1996, *M. A. Vincent 7245, Rhode & Snowden* (F, ISC, MO, MU, RSA, UC, US); cultivated plant, 12 May 1995, *R. Morgan 2566c* (MU, R. Morgan personal herbarium).

Acknowledgments. The following people assisted with this project: Lowell Ahart, R. James Hickey, Julie Horenstein, Vernon Oswald, Delores and Edward Rhode, and James Snowden. The following herbaria graciously lent specimens: CHSC, ISC, MO, UC. The W. S. Turrell Herbarium Fund (MU) supported fieldwork associated with this project.

Literature Cited

Beedy, E. C. & R. E. Preston. 1996. James Dent Jokerst. Amer. Soc. Pl. Taxonomists Newslett. 10(1) unpaginated (electronic publication).

Isely, D. 1993. *Trifolium* (Clover). Pp. 646–655 *in* J. C. Hickman (editor), The Jepson Manual: Higher Plants of California. Univ. California Press, Berkeley.

Jokerst, J. D. 1983. The vascular flora of Table Mountain, Butte County, California. Madroño 30: 1–18.

Kartesz, J. T. 1994. A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland, 2nd ed. Timber Press, Portland.

McDermott, L. F. 1910. An Illustrated Key to the North American Species of *Trifolium*. Cunningham, Curtis & Welch, San Francisco.

Oswald, V. H. & L. Ahart. 1994. Manual of the Vascular Plants of Butte County, California. California Native Plant Society, Sacramento.

Zohary, M. & D. Heller. 1984. The Genus *Trifolium*. Israel Academy of Sciences, Jerusalem.

New Taxa, New Combinations, and Observations in *Kengyilia* (Poaceae: Triticeae)

Chi Yen and Jun-Liang Yang
Triticeae Research Institute, Sichuan Agricultural University,
Dujiangyan City 611830, Sichuan, China

Bernard R. Baum
Eastern Cereals and Oilseeds Research Centre, Agriculture and Agri-Food Canada, Central Experimental Farm, K.W. Neatby Building, Ottawa, Ontario, Canada, K1A 0C6

ABSTRACT. A new species is described and five new combinations are made in *Kengyilia*. The new taxa are *Kengyilia eremopyroides* and *K. batalinii* var. *villosissima*. *Kengyilia longiglumis* and *K. nana* are reduced to *K. alatavica* var. *longiglumis* and *K. nana* to *K. batalinii* var. *nana*, respectively. *Roegneria carinata*, *Elytrigia kryloviana*, and *Elytrigia pulcherrima* are transferred to *Kengyilia* as *K. carinata*, *K. kryloviana*, and *K. pulcherrima*, respectively.

We first described *Kengyilia* Yen & J. L. Yang in 1990 (Yen & Yang, 1990) and soon afterward added a new species to it (Baum et al., 1991). Subsequently, we provided a synopsis and key to the 16 species of the genus known to us at the time (Yang et al., 1992). Cai and Cui (1995) have since added two more new species. This genus, now with approximately 20 species, is distributed primarily in west China, with some species found in countries west of China. We recently investigated the taxonomic relationships with and differences between its congeners *Roegneria*, *Elymus*, and *Agropyron* (Baum et al., 1995) and provided a key to identify these four genera. We are currently preparing a taxonomic monograph of *Kengyilia*. Toward this goal we are searching for type material in different herbaria.

A recent visit to the Komarov Botanical Institute, St. Petersburg, Russia, during the summer of 1995, by Yen and Yang was carried out to study type material of *Kengyilia*. Morphological examinations of specimens, especially type material, led to the conclusion that a number of species in *Kengyilia* were hitherto misnamed and that other species needed to be incorporated within *Kengyilia*. The purpose of this paper is to document the new combinations and revisions in *Kengyilia* resulting from the examinations carried out during the recent visit to LE.

Materials and Methods

Morphological examinations were performed on herbarium materials, including type collections, from the following herbaria: JSBI, K, LE, NUBD, PE, SAUTI, TK. Characters on these specimens were evaluated for quantitative and qualitative measurements and compared to various pertinent protologues for taxonomic assessment.

Results—Taxonomic Treatments

1. **Kengyilia alatavica** (Drobov) J. L. Yang, Yen & Baum var. **longiglumis** (Keng & S. L. Chen) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Roegneria longiglumis* Keng & S. L. Chen, Acta Nanking Univ. (Biol.) 1: 83. 1963. *Kengyilia longiglumis* (Keng & S. L. Chen) Yang, J. L., Yen & Baum, Hereditas 116: 27. 1992. TYPE: China. Gansu, on slopes, alt. 2500 m, July 6 1937, *T. P. Wang No. 7080* (holotype, PE). Figure 1A.

Distribution. China: Gansu, Xiahe; Xinjiang, Yecheng, Taxkorgan and between Wuqia and Turugar, on dry slopes and scree, alt. 2500–3340 m.

This taxon was known hitherto as *K. longiglumis*, from the Chinese material that was examined. Our comparative studies proved that *K. longiglumis* is a taxonomic synonym of *K. alatavica*. The Chinese material is here recognized as a separate variety; it differs from *K. alatavica* var. *alatavica* by its hairy leaf sheaths and culms, and by the short rounded lodicules (Fig. 1A). The pointed lodicules of the typical variety are shown in Figure 1B.

2. **Kengyilia batalinii** (Krassnov) J. L. Yang, Yen & Baum var. **villosissima** Roshevitz ex Yen, J. L. Yang & Baum, var. nov. TYPE: Turkestan. Pamir, near Karakuli Lake, July 5 1901 [collector & collection no. unretained] (holotype, LE). Figure 2.

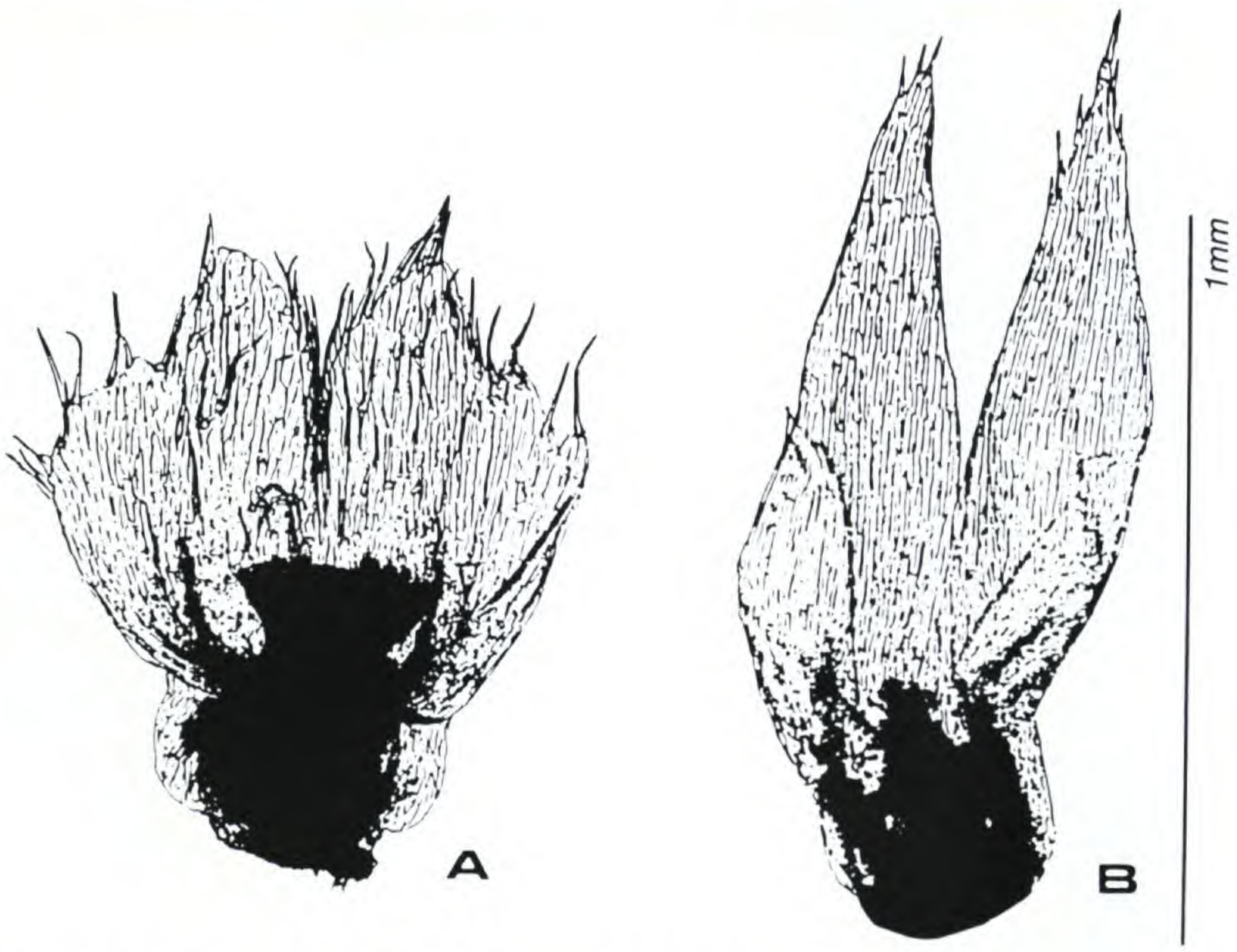


Figure 1. Lodicules of *K. alatavica* (Drobov) J. L. Yang, Yen & Baum. —A. Typical lodicules of variety *longiglumis* (Keng & S. L. Chen) Yen, J. L. Yang & Baum. —B. Lodicules found in variety *alatavica*.

Kengyliae batalinii (Krassnov) J. L. Yang, Yen & Baum affinis, sed laminis supernis dense villosis, laminis infernis glabris vel sparsim ciliolatis, spicis dense albus-villosis, glumis dense pubescentibus, lemmatibus dense villosis differt.

This variety differs from the typical variety by its leaf blades villous on the upper surface and glabrous or sparsely ciliate on the lower surface, the spikes densely white villous, and the glumes and the lemmas densely villous. See key below to identify this variety and the other two in *K. batalinii*.

Distribution. Turkestan.

3. Kengyilia batalinii (Krassnov) J. L. Yang, Yen & Baum var. **nana** (J. L. Yang, Yen & Baum) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Kengyilia nana* J. L. Yang, Yen & Baum, Canad. J. Bot. 71: 339–345. 1993. TYPE: China. Taxkorgan, Pamir Plateau, in alpine steppe, alt. 4200 m, Sep. 6 1987, *C. Yen et al. 870502* (holotype, SAUTI).

This variety differs from the typical variety in having leaf sheaths with densely pubescent or ciliate margins, leaf blades that are densely hairy on the adaxial surface and shortly pubescent on the abaxial surface, and slightly smaller spikes. It grows at higher elevations than variety *batalinii*.

Distribution. China.

This taxon was known hitherto as *K. nana*, now an established taxonomic synonym of *K. batalinii*.

The three varieties in *K. batalinii* may be distinguished by the following key.

1a. Leaf blades glabrous . . . . . var. *batalinii*
1b. Leaf blades beset with hairs at least on upper surface.
  2a. Leaf blades villous on upper surface, glabrous or sparsely ciliate on lower surface . . . . . var. *villosissima*
  2b. Leaf blades with short pubescence on upper surface, and with dense hairs on lower surface . . . . . var. *nana*

4. Kengyilia carinata (Ovczinnikov & Sidorenko) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Roegneria carinata* Ovczinnikov & Sidorenko, Fl. Tajik SSR 1: 505 (No. 310). 1957. TYPE: Russia. In the lower part of the northern slope of Jiptyk valley—a tributary of the Isfar, 28 June 1938, *Mikeshin, G. No. 79* (holotype, LE). Figure 3.

This species differs from *K. alaica* in having sturdy, densely tufted culms with 4–5 nodes, broad leaves, dense spikes, and glumes sparsely covered with long hairs.

Tzvelev (1976) treated *R. carinata* Ovcinnikov & Sidorenko as a synonym of *Elytrigia batalinii* subsp. *alaica* (Drobov) Tzvelev, based on the Mikeshin specimen of 26 July 1938, No. 79, probably by mistake confusing it with No. 81. The herbarium of the Komarov Botanical Institute (LE) has two

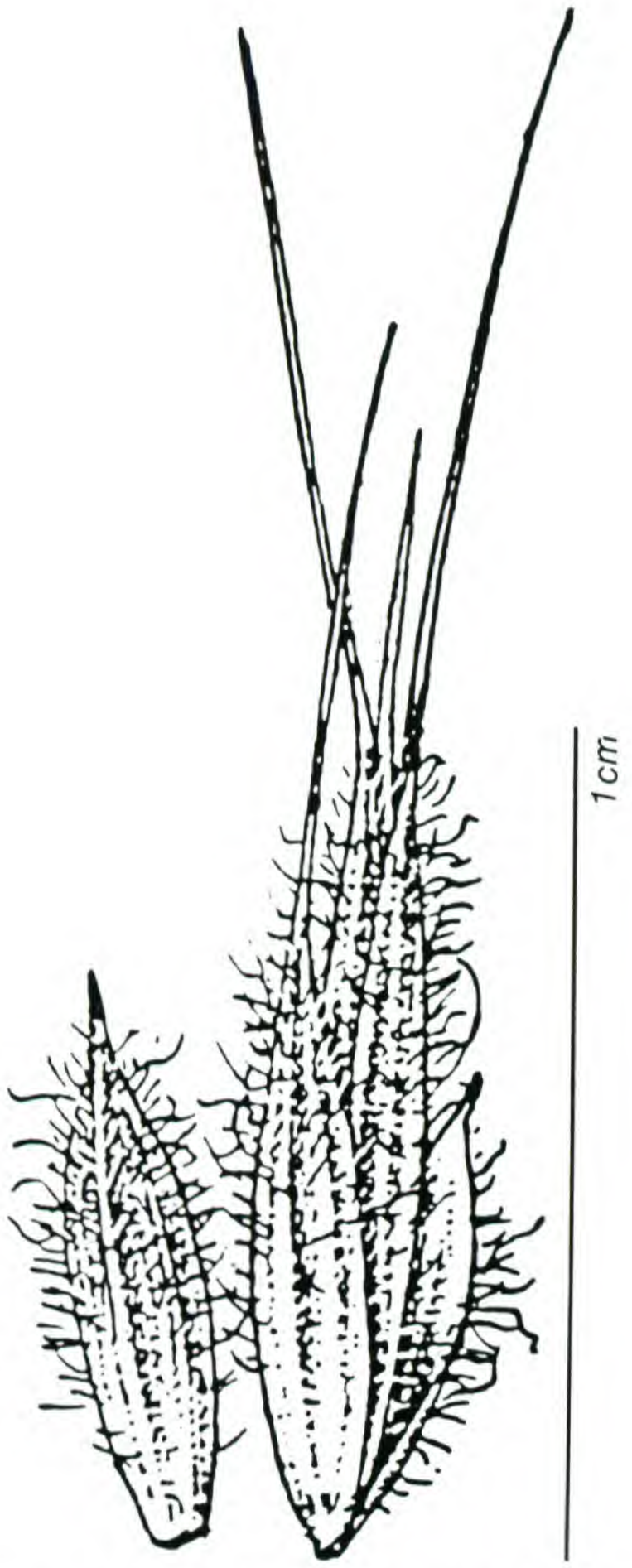


Figure 2. Spikelet of *Kengyilia batalinii* (Krassnov) J. L. Yang, Yen & Baum var. *villosissima* Roshevitz ex Yen, J. L. Yang & Baum, with the hairy glumes and lemmas. Left, upper glume.

sheets collected by J. B. Mikeshin. One is the type. The other is No. 81, collected on 10 Aug. 1938. Nevski annotated the type as *Roegneria abolinii* (Drobov) Nevski f. *breviaristata* Nevski. In 1956, P. N. Ovczinnikov annotated it as *Roegneria carinata*. The subsequent year he published *R. carinata* with Sidorenko. Thus, No. 79 is the holotype. In 1958 Melderis annotated this specimen as *Agropyron carinatum*. Specimen No. 81 is a loosely caespitose, delicate grass with 1–2 nodes, and culm and narrow leaves situated at the base of the plant, identified as *Kengyilia alaica* (Drobov) J. L. Yang, Yen & Baum. In March 1959 Tzvelev affixed the following annotation on this specimen "Roegneria carinata Ovczinnikov et Sidorenko Topotype = Agropyron alaicum Drob." We agree that it is "*A. alaicum* Drobov," but it is not "*R. carinata*," i.e., *Agropyron alaicum* and *Roegneria carinata* are different species.

5. Kengyilia eremopyroides Nevski ex Yen, J. L. Yang & Baum, sp. nov. TYPE: China. "Lacus Orin-Nor sole argilloso-sabuloso porce," alt. 3962 m (13000 ft.), 10/30 July 1884, *N. M. Przewalski No. 339* (holotype, LE). Figure 4.

Kengyiliae melantherae (Keng) J. L. Yang, Yen & Baum affinis, sed culmis sub inflorescentiis dense pubescentibus, laminis dense pilosis, spicis brevioribus (4–4.5 cm) et angustioribus, lemmatibus dense hirsutis non villosis differt.

This species resembles *Kengyilia melanthera* (Keng) J. L. Yang, Yen & Baum but differs in having the culm densely pubescent below the spikes, leaf blades that are densely pilose on both surfaces, narrower and shorter spikes, and densely long hirsute (but not villous) lemmas.

Perennials, with short rhizomes; culms densely caespitose, erect, 31–37 cm tall, about 1.5–2 mm diam., glabrous except for the upper internode pubescent below the spike, with 2 nodes. Leaf sheaths glabrous; ligules scarious membranous, truncate, about 0.5 mm long; leaf blades flat, (1.5–)2–5.5 cm long, 2.5–3 mm wide, their adaxial surface pilose and their abaxial surface densely pilose. Spikes erect, oblong, (3.5–)4–4.5 cm long, 8–10 mm wide; rachis internodes densely pilose, the uppermost internodes 1.5–2 mm long, the lowermost 5–7 mm long; spikelets ovoid, slightly secund, straw or purple colored, with 4–6 florets, 10–11 mm long (excluding awns); rachilla internodes 0.8–1.2 mm long, densely puberulous; glumes unequal, ovoid, 3–5-nerved, glabrous, acute, mucronate, first glumes 4–4.5 mm long, second glumes 4.5–5 mm long; lemmas ovate-oblong, 7–8 mm long, densely hirsute, apex acuminate ending with a 3–4 mm scabrous long awn; palea shorter than lemma, 0.5 mm long, with an emarginate apex, with keels sparsely ciliolate in their upper part; anthers black, 2 mm long.

Distribution. China, known only from the type locality.

The type specimen was initially annotated as a new species of Wheatgrass, namely *Agropyron eremopyroides*, by Nevski in 1931, but was never published.

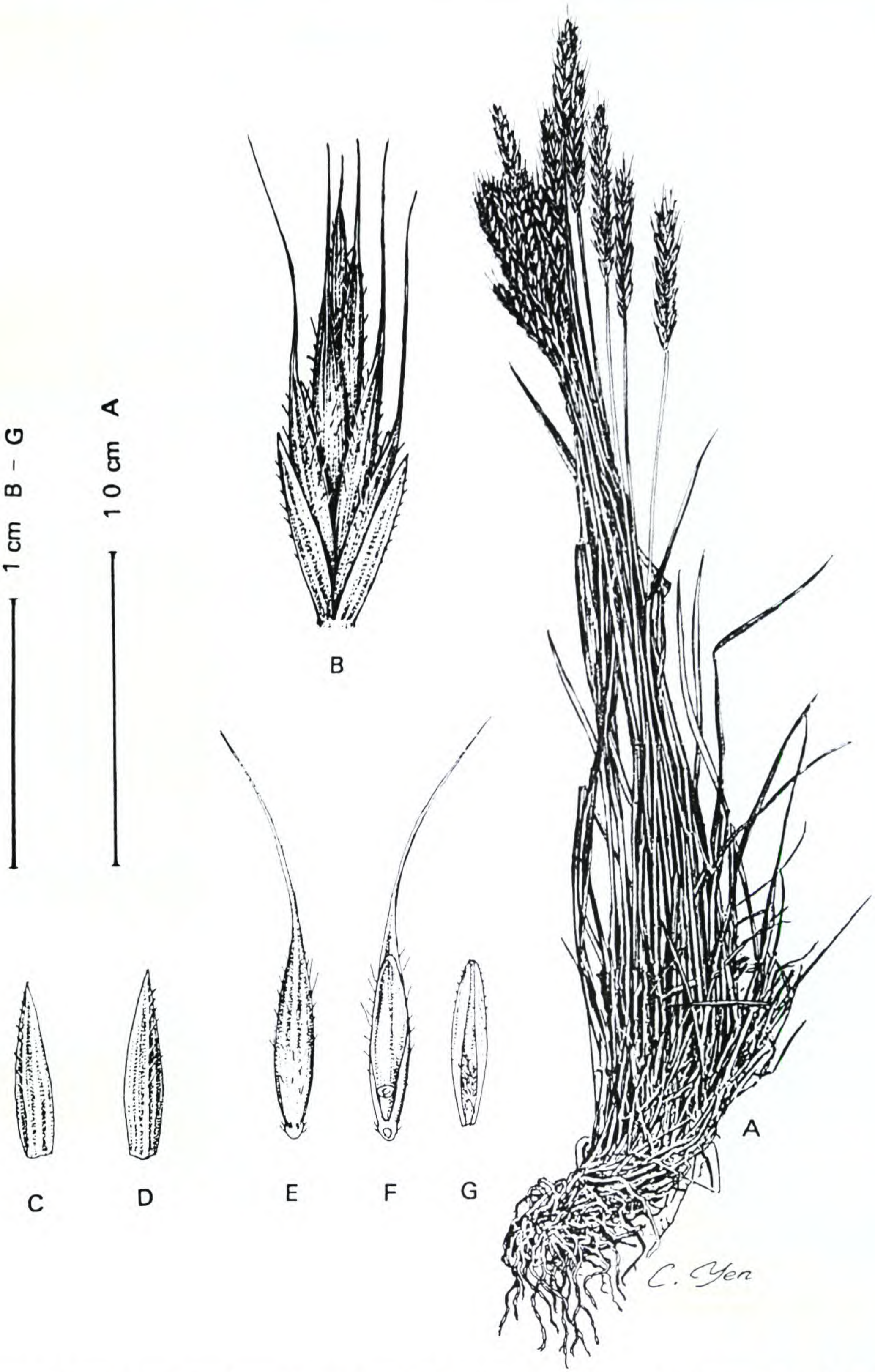


Figure 3. *Kengyilia carinata* (Ovczinnikov & Sidorenko) Yen, J. L. Yang & Baum. —A. Mature plant. —B. Spikelet. —C. Lower glume. —D. Upper glume. —E. Floret beset with sparse long hairs. —F. Ventral view of a floret. —G. Ventral view of a palea.

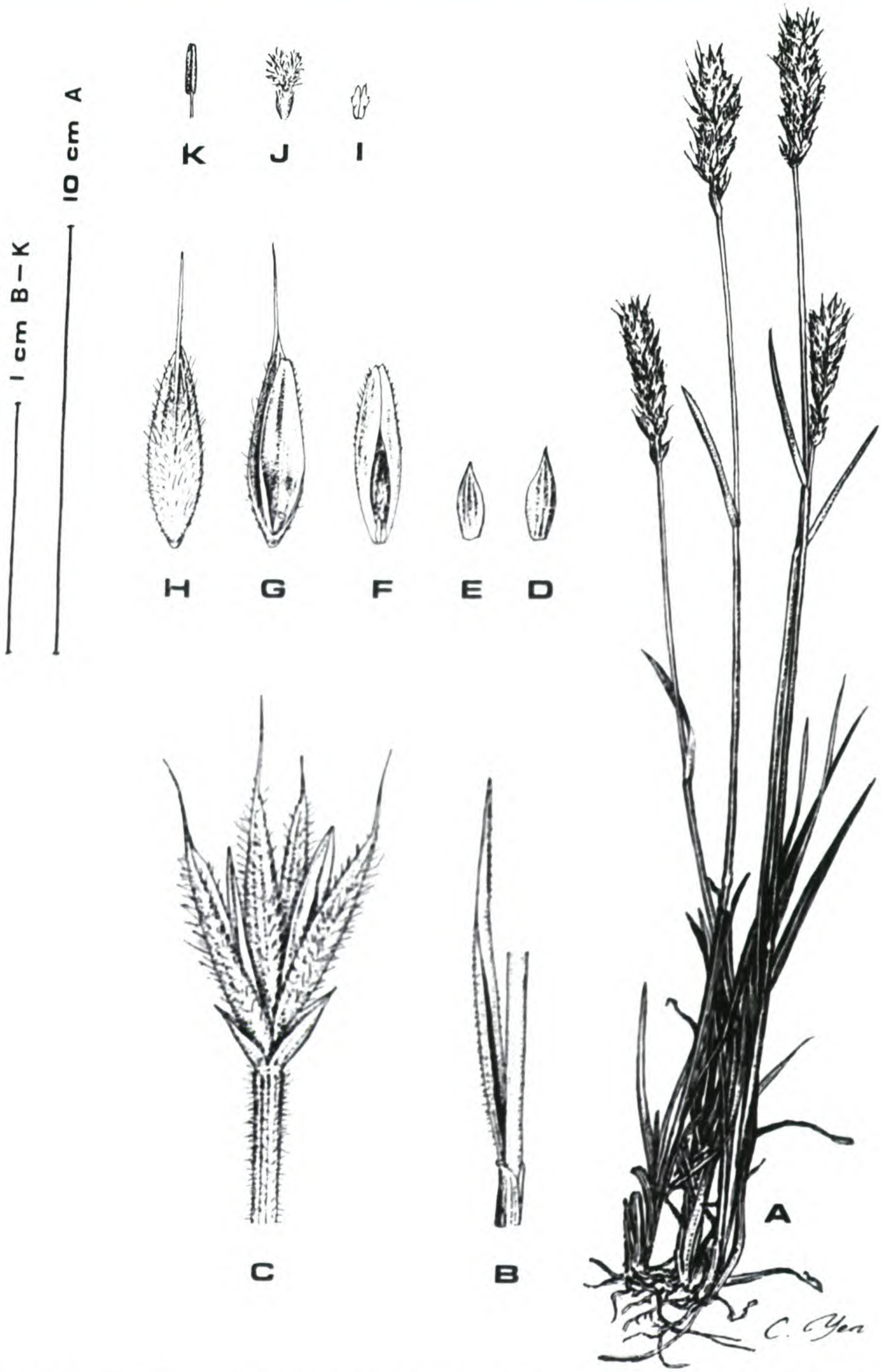


Figure 4. *Kengyilia eremopyroides* Nevski ex Yen, J. L. Yang & Baum. —A. Mature plant. —B. Flag leaf with puberulent blade. —C. Spikelet subtended by hirsute upper part of internode. —D. Upper glume. —E. Lower glume. —F. Ventral view of palea. —G. Ventral view of a floret. —H. Dorsal view of a floret. —I. Lodicule pair. —J. Ovary with stigma. —K. Anther.

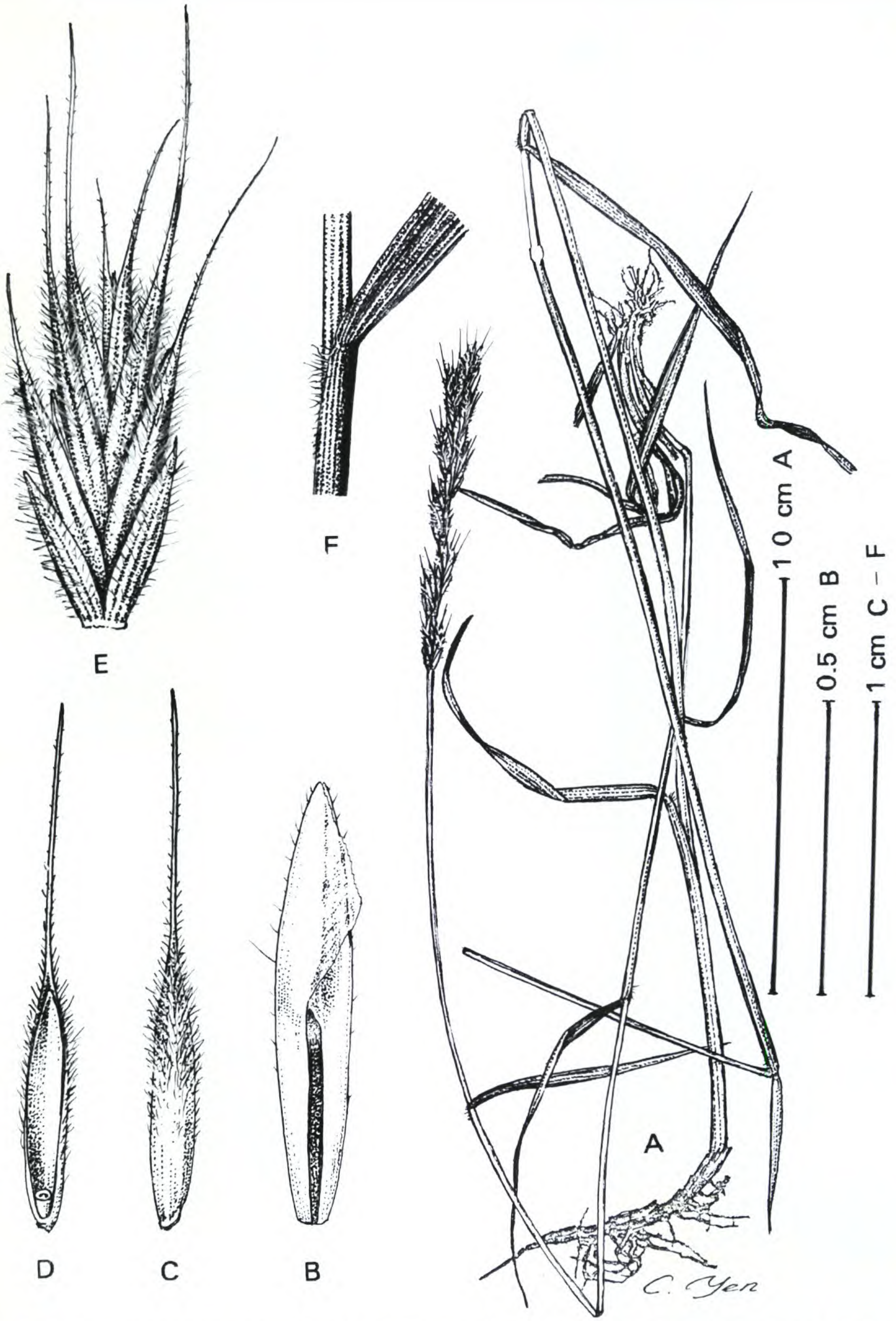


Figure 5. *Kengyilia pulcherrima* (Grossheim) Yen, J. L. Yang & Baum. —A. Mature plant. —B. Ventral view of palea, showing the two hyaline membranous, triangular large appendages on both sides of the upper margins. —C. Dorsal view of a floret. —D. Ventral view of a floret. —E. Spikelet. —F. Upper part of leaf sheath with ciliate margins.

Table 1. Differences between *Kengyilia kryloviana* and *K. habahenensis*.

	K. kryloviana	*K. habahenensis*
Spike length	3–8 cm	8–12 cm
Spikelet width	5 mm	2 mm
Lemma backs	densely and long pilose	covered with soft short hairs
Palea tips	pointed	short retuse
Habitat	stony and grassy slopes	in *Larix* forest and bushes and dense vegetation

6. **Kengyilia kryloviana** (Schischkin) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Agropyron krylovianum* Schischkin, Fl. Zapod. Sibir. 2: 353. 1928. (Animadvers. syst. ex Herb. Univ. Tomsk No. 2). *Elytrigia kryloviana* (Schischkin) Nevski, Tr. Bot. Inst. Akad. Nauk SSSR, ser. 1, 2: 84. 1936. TYPE: Russia. West Siberia, Altai, Valley of river Chuya (holotype, TK).

Distribution. Stony and grassy slopes, rocks and screes of the middle mountain belt in Russia (West Siberia: Irtysh, Altai; East Siberia: Angana-Satan) and Kazakhstan (Northern Balkhash).

Earlier (Baum et al., 1991), we suspected that this species, formerly belonging to *Agropyron* (Tzvelev, 1976: 145), might belong to *Kengyilia*. Essential differences between this species and *Kengyilia habahenensis* Baum, Yen & J. L. Yang are given in Table 1.

7. **Kengyilia pulcherrima** (Grossheim) Yen, J. L. Yang & Baum, comb. nov. Basionym: *Agropyron pulcherrimum* Grossheim, Tiflis Bot. Sada [Moniteur du Jardin Botanique de Tiflis] 13–14: 42. 1919 (also Plate 4, fig. 1–5). *Elytrigia pulcherrima* (Grossheim) Nevski, Tr. Sredneaz Univ. Ser. 17: 51. 1934. *E. intermedia* (Host) Nevski subsp. *pulcherrima* (Grossheim) Tzvelev, Novost. Sist. Vyssh. Rast. 10: 31. 1973. TYPE: Turkey. "Prov. Kars, distr. Ardahan, prope Guljabert, in locis stepposis, 25/7/1914, *A. Grossheim*" (holotype and isotype, LE). Figure 5.

Agropyron intermedium var. *ambigens* Haussknecht in Halácsy Consp. Fl. Graec. 3: 437. 1904. *A. ambigens* (Haussknecht) Roshevitz, Fl. Turkm. 1: 191. 1932. TYPE: Greece. "Iter Graecum, Pindus Tymphaeus prope Malakassi, in schistosis, 18 VII 1886, *C. Haussknecht*" (isotype, LE).

Agropyron popovii Drobov, Feddes Rep. 21: 44. 1925. TYPE: Turkumenistan. "Distr. Askhabad, 1921, *M. Popov No. 706*" (lectotype, designated by Tsvelev (1976), TAK).

Distribution. Russia, Caucasus, eastern and southern Transcaucasia; Turkumenistan; Tian-Shan; Syr Darya; Balkans; and Iran on slopes in steppe.

This species has a unique morphological feature, not found in other *Kengyilia* species and related genera. This is the large, hyaline, triangular appendages on both sides of the upper margins of the palea (Fig. 5B).

Acknowledgment. The authors thank J. Cayouette, Agriculture & Agri-food Canada, Ottawa, for help with the Latin and for useful comments.

Literature Cited

Baum, B. R., C. Yen & J. L. Yang. 1991. *Kengyilia habahenensis* (*Poaceae*: *Triticeae*)—a new species from the Altai mountains, China. Pl. Syst. Evol. 174: 103–108.

———, J. L. Yang & C. Yen. 1995. Taxonomic separation of *Kengyilia* (*Poaceae*: *Triticeae*) in relation to nearest related *Roegneria*, *Elymus*, and *Agropyron*, based on some morphological characters. Pl. Syst. Evol. 194: 123–132.

Cai, L. B & D. F. Cui. 1995. New taxa of the genus *Kengyilia* from China. Bull. Bot. Res. 15: 422–427.

Tzvelev, N. N. 1976. Grasses of the Soviet Union. Zlaki SSSR. Nauka, Leningrad [Translated for the Smithsonian Institution from Russian, Washington, 1963].

Yang, J. L., C. Yen & B. R. Baum. 1992. *Kengyilia*: synopsis and key to species. Hereditas 116: 25–28.

Yen, C. & J. L. Yang. 1990. *Kengyilia gobicola*, a new taxon from west China. Canad. J. Bot. 68: 1894–1897.

Identity and Typification of *Dracontium dubium* Kunth (Araceae)

Guanghua Zhu
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

Julius O. Boos
1368 Scottsdale Road East, West Palm Beach, Florida 33417, U.S.A.

Thomas B. Croat
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. A neotype and epitype are selected for *Dracontium dubium* Kunth. *Dracontium changuango* G. S. Bunting is treated as a synonym of *D. dubium*.

Dracontium dubium Kunth was first collected by Richard Schomburgk during an expedition to Guyana (British Guiana) in 1840–1844 at the base of Mt. Curassawaka of the Kanuku Mountains, south of Nappi (ca. 3°22′N, 59°34′W), and several living tubers were sent to the Botanical Garden of Berlin in 1843 (Roth, 1922: 387–388, 1923: 103). One plant bloomed in the Garden and was described by Kunth in the following year (Kunth, 1844). Schott (1860: 481) noted that there were fertile collections of this species at the Berlin Herbarium (B). However, no such specimen of *D. dubium* was seen by Engler in 1911, when he only cited "Bluehte im Bot. Garten zu Berlin Sept. 1844" under the species. Schott (1860) might very likely have seen only live specimens of the species, since at Kunth's time garden plants were often described and illustrated without preparing herbarium specimens (Paul Hiepko, pers. comm.). Kunth had apparently made a drawing of the inflorescences and some floral details of the species, which was deposited in the Berlin herbarium (Engler, 1911: 38, fig. 14A–F). More than a decade after the discovery of *D. dubium*, Schott (1857), based on unspecified ovary and stigma details of the species, described the new genus *Echidnium*, giving the single species a new name, *E. schomburgkii*. In the following year, Schott (1858b: pl. 88) published a plate under the name *E. schomburgkii*, which copied Kunth's drawing but added an opened inflorescence and other floral details. Later, when he published the first comprehensive classification of the Araceae, Schott (1860) accepted the name *E. schomburgkii*, citing *Dracontium dubium* as a synonym. Under contemporary rules, *E. schomburgkii* is a superfluous name, since Schott should have used the name *E. dubium* for the transfer. Engler (1911) rectified this situation by publishing the combination *Echidnium dubium* (Kunth) Engler.

Echidnium is ostensibly distinguished from *Dracontium* by having a unilocular ovary with two ovules (Schott, 1857), as opposed to a bi- or plurilocular ovary in *Dracontium*. However, these characters have been shown to be either spurious (Zhu, 1995) or not to be good generic characters in this group (Bogner, 1985; Hay, 1988; Zhu, 1996). The two plates originated from the typical material of *D. dubium* (Genera aroidearum, pl. 88, Schott, 1858b; Das Pflanzenreich, 4 (23C): p. 38, fig. 14A–F, Engler, 1911) clearly demonstrated a plant of at least two locules. Schott's statement of a unilocular ovary was evidently erroneous, based on his own illustration. Zhu (1995, 1996) noted that unilocular ovaries do not occur in *Dracontium*, and this genus never has more than one ovule in each locule; these stand as generic traits of the genus. Therefore, *Echidnium* is accepted as a synonym of *Dracontium*, and *D. dubium* is the accepted name for the treated species.

The selection of a neotype is indicated for the name *Dracontium dubium* Kunth, because no original material exists (Greuter et al., 1994, Art. 9.7). The fertile collections of this species studied by Schott (1860) were either living specimens and never preserved as herbarium specimens or were lost before Engler's time. The drawing made by Kunth (Engler, 1911) at the Berlin herbarium (B) was presumably destroyed during wartime, or otherwise lost (Paul Hiepko, pers. comm.). If Schomburgk made any herbarium collection in the field, this collection is also untraceable. Plate 88 (Fig. 1) in the *Genera aroidearum* (Schott, 1858b) was clearly based on a specimen of Schomburgk's collection of this taxon, and thus affords the most reliable reflection of the original description (Schott,

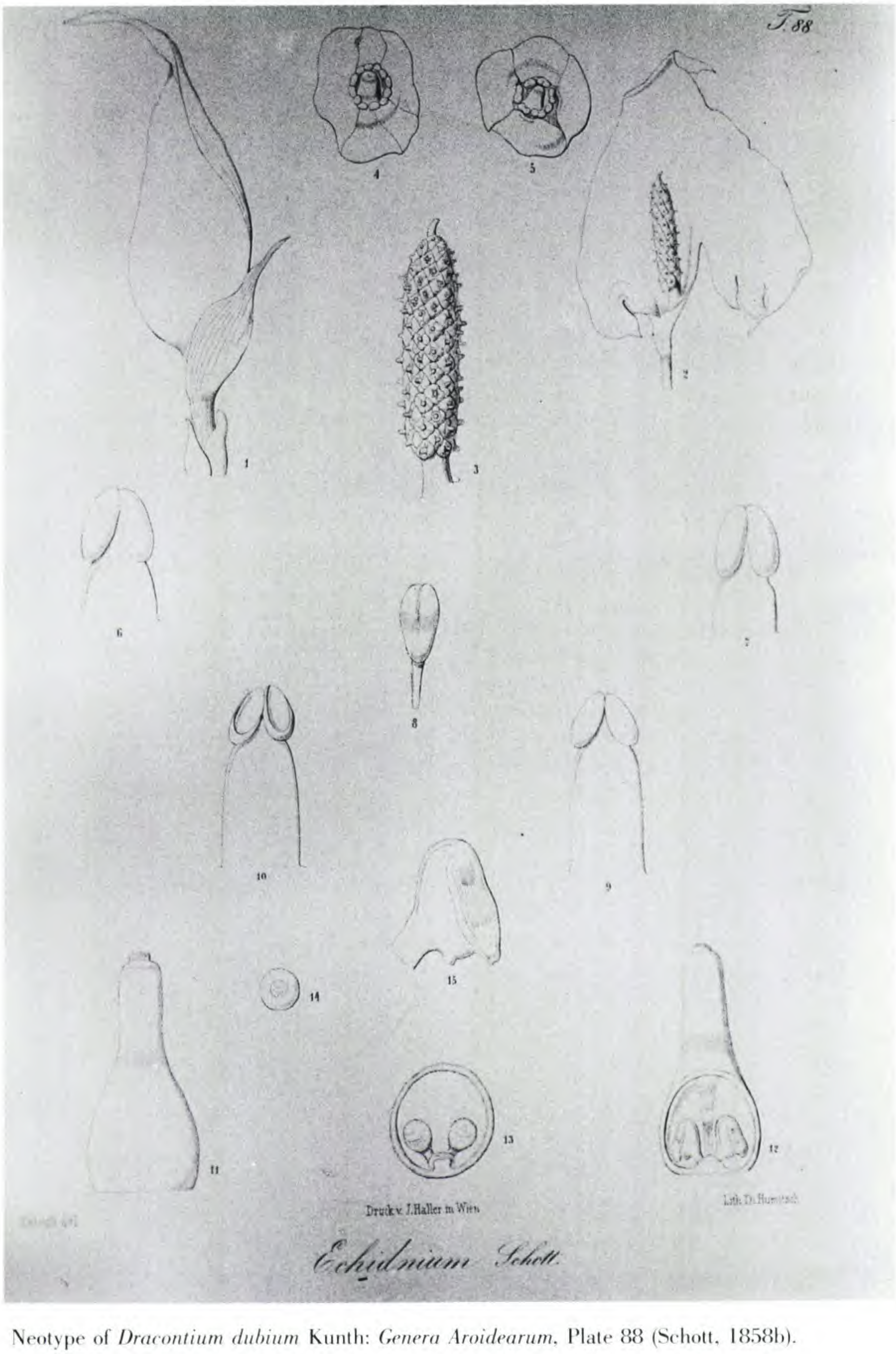


Figure 1. Neotype of *Dracontium dubium* Kunth: *Genera Aroidearum*, Plate 88 (Schott, 1858b).

1858a). Therefore this plate (Fig. 1) is here designated as the neotype of *Dracontium dubium* Kunth.

Because the neotype is an illustration rather than a specimen, some characters important to the systematics of *Dracontium*, such as the texture of the inner spathe surface, are not discernable. The Tokyo Code (Greuter et al., 1994, Art. 9.7) permits the designation of an interpretative epitype for such a situation. The plant depicted in the neotype illustration of *Dracontium dubium* has an apical appendage on the spadix (Fig. 1), a character known to occur only in a few species of *Dracontium*. Among specimens originating from areas adjacent to the typical locality of *D. dubium*, several from Venezuela possess this character. One of these, *Bunting 3677B* (cultivated at Maracay; originally collected from Síquita near San Fernando de Atabapo on Rio Orinoco, Atures Department of Ama-

zonas State), also has an identical spathe with the neotype of *D. dubium.* Therefore, *Bunting 3677B* (NY) is here designated as the epitype of the name *D. dubium.*

Dracontium changuango G. S. Bunting (Bunting, 1986) is characterized by having the inner surface of the spathe covered with dense, translucent scales (1–2 mm long) and a spadix that often has apical appendages. Based on the previous epitypification, no features separate *D. dubium* and *D. changuango.* Therefore, *D. changuango* is here considered a synonym of *D. dubium.*

The nomenclature and synonymy of *Dracontium dubium* Kunth are as follows:

Dracontium dubium Kunth, Ind. Sem. Hort. Berol. 1844: 283. 1844. *Echidnium schomburgkii* Schott, Oesterr. Bot. Wochenbl. 8: 62.1857, nom. superfl. *Echidnium dubium* (Kunth) Engler, Pflanzenr. IV. 23C (Heft 48): 38. 1911. TYPE: British Guiana. Mt. Curassawaka of the Canuku Range, S of Nappi, 1843, *Richard Schomburgk s.n.* (holotype, B? lost). Pl. 88 in Schott, *Gen. Aroid.*, 1858 (neotype, here designated). Venezuela. Cultivated at Maracay, originally collected from Síquita near San Fernando de Atabapo on Rio Orinoco, Atures Department of Amazonas State, Amazonas, Atures, *Bunting 3677B* (epitype, here designated, NY).

Dracontium changuango G. S. Bunting, Phytologia 60: 302, figs. 13–14. 1986. TYPE: Venezuela. Carabobo: Caño Paso Ancho, ca. 6 km S of Valencia, near El Paito, *Bunting 2856* (holotype, MY; isotypes, MO, NY).

Acknowledgments. We thank Mike Grayum for discussions and critical suggestions on this subject. We also thank Paul Hiepko, William D'Arcy, Petra Malesevich, and Hong Song for other assistance.

Literature Cited

Bogner, J. 1985. One new name and five new combinations in Araceae. Aroideana 8: 73–79.

Bunting, G. S. 1986. New taxa of Venezuelan Araceae. Phytologia 60: 293–344.

Engler, A. 1911. Araceae–Lasioideae. Pp. 1–130 *in* A. Engler, Das Pflanzenreich 4 (23C).

Greuter, W., F. R. Barrie, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva, P. Trehane & J. McNeill (editors). 1994. International Code of Botanical Nomenclature (The Tokyo Code), Adopted by the XVth International Botanical Congress, Yokohama, August–September, 1993. Regnum Veg. 131.

Hay, A. 1988. *Cyrtosperma* (Araceae) and its Old World allies. Blumea 33: 427–469.

Kunth, A. C. 1844. Plantae novae: Horti regii botanici Berolinensis. Ind. Sem. Hort. Berol. 1844: 283.

Roth, W. E. 1922. Richard Schomburgk's travels in British Guiana (1840–1844), Vol. I. Daily Chronicle, Main Street, Georgetown.

———. 1923. Richard Schomburgk's travels in British Guiana (1840–1844), Vol. II. Daily Chronicle Office, Main Street, Georgetown.

Schott, H. W. 1857. Aroideae. Oesterr. Bot. Wochenbl. 8: 61–62.

———. 1858a. Aroideen-Skizzen. Oesterr. Bot. Z. 8: 349–351.

———. 1858b. Genera aroidearum. Vindobonae.

———. 1860. Prodromus Systematis Aroidearum. Vindobonae.

Zhu, G. H. 1995. Systematics of *Dracontium* L. (Araceae). Ph.D. Dissertation, University of Missouri-St. Louis, St. Louis, U.S.A.

———. 1996. The generic affinity of *Echidnium spruceanum* Schott and its placement in *Dracontium* (Araceae). Novon 6: 308–309.

Volume 8, Number 1, pp. 1–104 of NOVON was published on 23 April 1998.

Volume 8
Number 2
1998

NOVON

Novelties in Neotropical Sapindaceae II. Notes on *Averrhoidium*, *Serjania*, and *Porocystis*

Pedro Acevedo-Rodríguez

Smithsonian Institution, Dept. of Botany, National Museum of Natural History, NHB-166, Washington, D.C. 20560, U.S.A.

ABSTRACT. The study of recently collected specimens of neotropical Sapindaceae reveals the need for various taxonomic changes. *Matayba spondioides* Standley from Mexico is transferred to *Averrhoidium*; *Paullinia lachnocarpa* Bentham ex Radlkofer (*Chimborazoa lachnocarpa* (Bentham ex Radlkofer) H. Beck) from Ecuador is transferred to *Serjania* (therefore, *Chimborazoa* is reduced to the synonymy of *Serjania*); and *Toulicia acuminata* Radlkofer from Amazonas, Brazil, is transferred to the closely related *Porocystis*.

RESUMEN. El estudio de especímenes de Sapindaceas neotropicales, recientemente coleccionados revela la necesidad de varios cambios taxonómicos. *Matayba spondioides* Standley de México es transferido al género *Averrhoidium*; *Paullinia lachnocarpa* Bentham ex Radlkofer (*Chimborazoa lachnocarpa* (Bentham ex Radlkofer) H. Beck) del Ecuador es transferido al género *Serjania* (como resultado el género *Chimborazoa* es reducido a sinonimia con *Serjania*); *Toulicia acuminata* Radlkofer proveniente de Amazonas, Brasil, es transferido al género cercano *Porocystis*.

When Paul Standley described *Matayba spondioides* in 1927, he cast some doubt on whether the species belonged in this genus. He placed the new species in *Matayba* because "It appears to agree better with that [*Matayba*] than with any other American group of the family." Examination of the type material, as well as of a recent collection, reveals that this species belongs in *Averrhoidium* Baillon, a South American genus with two species, *A. gardnerianum* Baillon from northeastern Brazil and *A. paraguaiense* Radlkofer from Paraguay. *Averrhoidium* is distinguished from *Matayba* by its 2-ovulate carpels (vs. 1-ovulate); by its unilocular (by abortion), tardily dehiscent capsules, with 1(–2) seeds per locule, and chartaceous to crustose pericarp (vs. 2–3-locular, early dehiscent capsules with 1 seed per locule, and coriaceous to woody pericarp); by its seeds with slightly fleshy testa, without arillode (vs. seeds with a woody testa with a basal arillode); and by its apetalous (or nearly so) flowers (vs. flowers with 5 well-developed petals). Because these characters (except for the flowers, which are unknown) are observable in *M. spondioides*, this species is herein transferred to *Averrhoidium*.

Averrhoidium spondioides (Standley) P. Acevedo-Rodríguez & M. S. Ferrucci, comb. nov. Basionym: *Matayba spondioides* Standley, in R. S. Ferris, Contr. Dudley Herb. 1: 77. 1927. TYPE: Mexico. Nayarit: María Madre Island (Tres Marías Islands), wooded slopes near the ocean below Balleto Point, 25 Oct. 1925 (fr), *R. S. Ferris 5721* (holotype, CAS; isotype, US).

Additional specimen examined. MEXICO. **Jalisco:** La Huerta, Cumbres de Cuixmala, km 45 on road from Rancho Cuixmala to Cumbres I, 19°25′N, 104°58′W, 50 m, 25 Aug. 1988 (fr), *R. Acevedo R. & J. L. Martínez 956* (US).

Chimborazoa H. Beck was described in 1992 to accommodate the odd-looking *Paullinia lachnocarpa* Bentham ex Radlkofer, whose schizocarpic fruits clearly differ from the septifragal capsules that characterize *Paullinia* L. Examination of fruiting

material available at that time showed *P. lachnocarpa* to be different from any of the remaining genera of Paullinieae. Thus, the new genus *Chimborazoa* was proposed by Beck (1992). However, examination of additional material of *C. lachnocarpa* showed that its immature fruits contain a proximal wing, similar to fruits of *Serjania* Miller. The only character used to differentiate this species from other species of *Serjania* is precisely the absence of mericarpic wings in mature fruits. The discovery of vestigial wings in young fruits of *P. lachnocarpa* definitively links this species with *Serjania*.

It seems at first that the loss of the mericarpic wing in *P. lachnocarpa* would be sufficient grounds for describing it as a distinct genus, perhaps on the assumption that a different fruit morphology should result in a different dispersal mode. Therefore, it would be a character with biological significance. In evaluating whether this phenomenon merits generic recognition or not, I noted that a few other species of *Serjania* (*S. cissoides* Radlkofer, *S. herterii* Ferrucci, and *S. macrococca* Radlkofer) can contain mericarps with vestigial wings or lack them altogether.

The recognition of *Chimborazoa* (which is based on the loss of the mericarpic wing) requires that the aforementioned species of *Serjania* be transferred to *Chimborazoa*. However, these species do not seem to be closely related, as they differ greatly in many morphological features, suggesting that the loss of mericarpic wings has occurred along different lineages in *Serjania*. Therefore, *Chimborazoa* as currently circumscribed would result in a polyphyletic taxon.

Since the recognition of *Chimborazoa* would result in an artificial taxon, it should be regarded as a synonym of *Serjania*, necessitating the transfer of *P. lachnocarpa* to *Serjania*.

Serjania lachnocarpa (Bentham ex Radlkofer) P. Acevedo-Rodríguez, comb. nov. Basionym: *Paullinia lachnocarpa* Bentham ex Radlkofer, Monogr. Paullinia 124. 1895–1896. *Chimborazoa lachnocarpa* (Bentham ex Radlkofer) H. Beck, Brittonia 44: 308. 1992. TYPE: Ecuador. Andes, 1857–1859 (fl, fr), *Spruce 6011* (lectotype, designated by Beck (1992: 308), K; isolectotypes, C, F, G, GH, M, NY—2, P, S—2).

Additional specimen examined. ECUADOR. **Bolívar:** Sicoto, along road from Guaranda to San Pablo de Atenas, cloud forest, 1°50′S, 79°05′W, 2200–2450 m, 28 Aug. 1987 (fr), *V. Zak & J. Jaramillo 2545* (US).

Porocystis Radlkofer belongs to the tribe Sapindeae along with six other genera, including *Toulicia* Aublet, its closest relative. *Porocystis* and *Toulicia* have similar habit and floral morphologies and can only be distinguished by their fruits and embryos. Whereas both genera have schizocarpic, membranous to chartaceous fruits, and embryos with fleshy cotyledons, they differ in other respects. *Toulicia* has mericarps that are samaroid, containing a distal, slightly flattened cocci and a proximal wing. In addition, the embryos of *Toulicia* have a curved, external cotyledon and a plicate internal one. *Porocystis*, on the other hand, has mericarps with a large, central, inflated or slightly flattened coccus that are wingless. Both cotyledons of the embryos in *Porocystis* are straight.

Porocystis has two species, of which the fruits are well known. In contrast, *Toulicia* has 14 species, but fruits are known for only 7 of them. The placement in *Toulicia* of species for which fruits are not known awaits confirmation, because it is possible that some of them might belong in *Porocystis*. Examination of fruiting material of *Toulicia acuminata* Radlkofer reveals that this species is better placed in *Porocystis*. Therefore, a new combination and a description of the fruits are herein provided.

Porocystis acuminata (Radlkofer) P. Acevedo-Rodríguez, comb. nov. Basionym: *Toulicia acuminata* Radlkofer, in Mart., Fl. Bras. 13(3): 505. 1900. SYNTYPES: Brazil. Amazonas: Manaus, in forest, Apr. 1882 (fl), *Schwacke 4001* (GOET); s.d. (fl), *Glaziou 13631* (B destroyed?).

Fruits schizocarpic, 2- or 3-carpellate, broadly obovate in outline, chartaceous, reticulate-veined, minutely tomentose; mericarps slightly inflated, 3.2–3.4 × 2.6–2.8 cm, with dorsal suture compressed into a narrow wing; endocarp glabrous. Seed (immature) bean-shaped and tomentose.

Additional specimens examined. BRAZIL. **Amazonas:** Rio Cuieiras, 5 km upstream, igapó forest, 5 Apr. 1974 (fl), *Campbell, D. G. et al. P21847* (US); Rio Cuieiras, 28 Apr. 1975 (fr), *Carreira L. 57* (INPA).

Acknowledgments. I thank John Pruski (US) and Mark T. Strong (US) for reviewing the manuscript, and R. Laurie Robbins for valuable comments.

Literature Cited

Beck, H. T. 1992. *Chimborazoa* (Sapindaceae), a new genus from Ecuador. Brittonia 44: 306–311.

Standley, P. 1927. *In:* R. Stinchfield Ferris, Preliminary report on the flora of the Tres Marías Islands. Contr. Dudley Herb. 1: 63–88.

Two New Species of *Brachymenium* (Bryaceae) from Central America, with a Key to the Species of *Brachymenium* in Central America

Bruce Allen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Brachymenium debilinerve* differs from *B. speciosum* by its dark green color, weak costa, well-spaced, flat, caducous leaves having numerous quadrate alar cells, and a weakly developed limbidium. *Brachymenium exoticosporum* differs from all members of the genus in having massive, mostly linear, endosporic protonemata with mostly vertical end-walls. The endosporic protonemata of *B. exoticosporum* appear similar to those found in *Ephemeropsis trentepohlioides.* A key to the 16 species of *Brachymenium* in Central America is given.

Brachymenium is a mostly tropical or subtropical genus of about 70 species (Ochi, 1992). Nearly all *Brachymenium* species have hexagonal to rhomboidal upper leaf cells, excurrent costae, and apiculate to hair-pointed leaves. Many of the common species also have quadrate basal leaf cells. The *Brachymenium* gametophyte is mostly indistinct, and sterile material can be difficult to distinguish from *Bryum* or *Acidodontium.* The *Brachymenium* sporophyte has erect to suberect capsules with conic-apiculate to short-beaked opercula. Its peristome is diplolepidous with narrow, densely papillose exostome teeth and a reduced endostome. The *Brachymenium* endostome has a high or low basal membrane with the segments and cilia generally rudimentary to absent. When the segments and cilia are rudimentary, they are morphologically identical and as such the two structures can be identified only by their position relative to the exostome teeth. This endostome condition is often termed erose. A good example of the loss of segment/cilia differentiation in *Brachymenium* occurs in the bizarre endostome of *B. columbicum* (De Notaris) Brotherus (see Shaw, 1984). This endostome has a high basal membrane from which arise 16 morphologically similar, lanceolate structures. Each lanceolate structure is positioned opposite an exostome tooth and represents a cilia/segment complex consisting of 4 fused parts: 2 cilia (in the center of the linear structure) with ½ of a segment on either side.

Brachymenium has been divided into five sections (see Ochi, 1980, 1992) based on features such as plant size, operculum shape, capsule shape and size, spore size, limbate condition of the leaves, and peristome structure. The sections, however, have species with reticulating character combinations that serve as intermediates between the sections, making it sometimes difficult to separate them (Ochi, 1980). Some of the present sectional characteristics may be of minor phylogenetic importance (i.e., plant and capsule size, presence or absence of leaf border), and an analysis of the genus focusing on more reliable features (i.e., exostome and endostome morphology, spore size, basal leaf cell shape) within the context of an in-depth sister-group character analysis is needed before a more natural subgeneric classification can be proposed.

There are 16 species of *Brachymenium* in Central America, 2 of which are described below as new to science, in preparation for the next volume of the *Moss Flora of Central America* (Allen, 1994).

Brachymenium debilinerve B. H. Allen, sp. nov. TYPE: Panama. Chiriquí: Fortuna Dam region, along trail to Cerro Hornito (Pate de Macho) on southern ridge of watershed, 8°45′N, 82°15′W, 1800–1950 m, *McPherson 13595D* (holotype, MO; isotype, PMA). Figure 1A–H.

A *B. specioso* (Hooker f. & Wilson) Steere foliis atrovirentibus, planis, caducis, limbidio debili, cellulis alaribus quadratis, costaque debili differt.

Plants large, dark green, in loose tufts, moderately tomentose below. Stems to 30 mm long, epidermal cells rectangular, rhizoids reddish brown, papillose. Leaves equally foliate, distantly spaced, 3–5 mm long, erect-flexuous, at times weakly twisted, erect-spreading when wet, plane, ovate to oblong-lanceolate, long-acuminate, often asymmetrically curved above, margins not or faintly and indistinctly bordered by 1–2 rows of somewhat longer, narrower cells, entire below, serrate to denticulate above, the teeth single or occasionally double, plane; costa thick at base and tapering above, ½ to ⅔ the leaf length; cells firm-walled throughout, sometimes porose, upper cells long-rhomboidal,

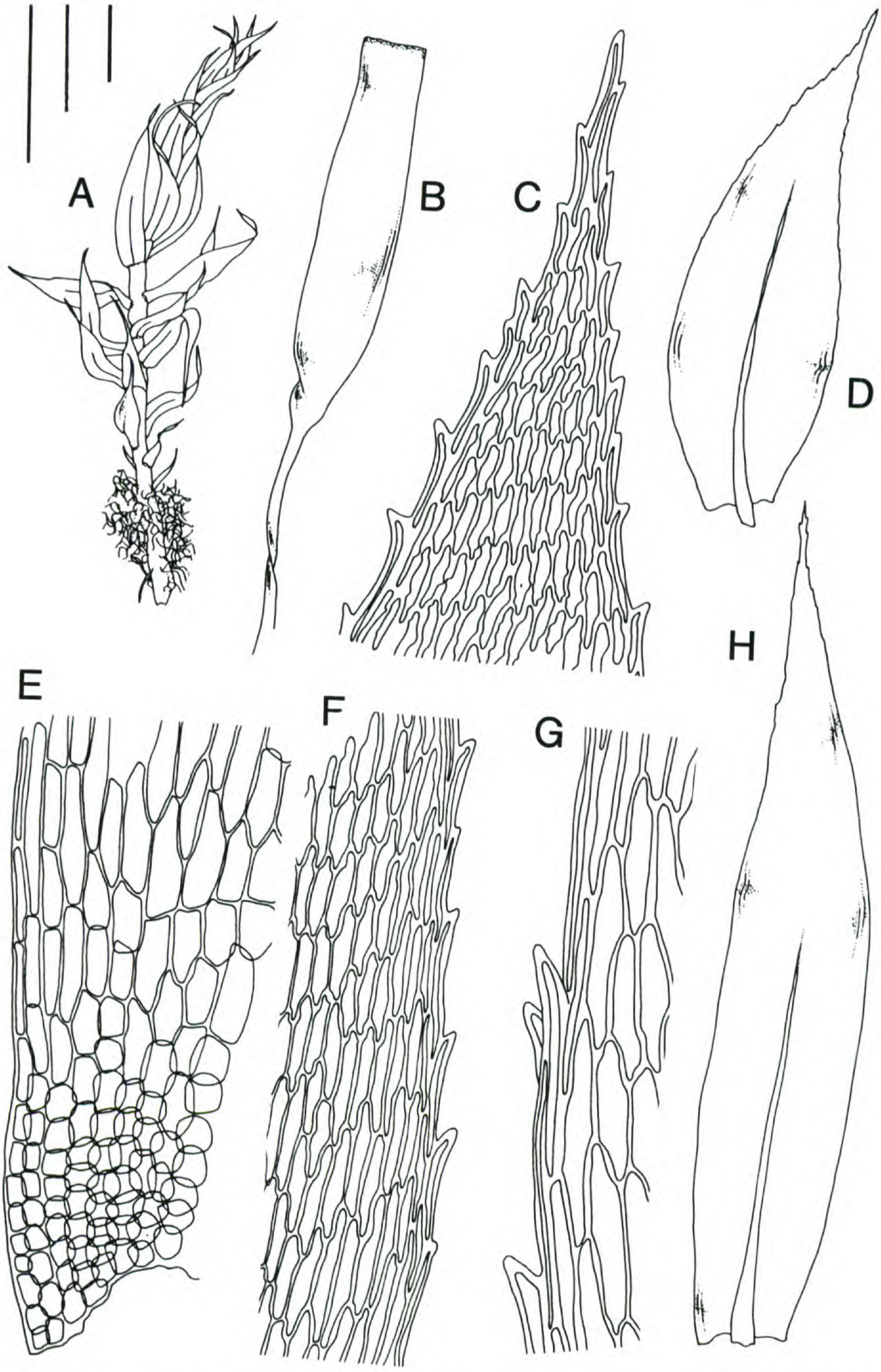


Figure 1. *Brachymenium debilinerve* B. H. Allen. —A. Habit. —B. Capsule. —C. Leaf apex and upper leaf cells. —D & H. Leaves. —E. Basal cells in alar region. —F. Leaf margin and median leaf cells. —G. Leaf margin showing occasional double toothing. Scales in mm: left = 0.5 (B); middle = 0.5 (D, H); middle = 0.1 (C, E, F); middle = 0.05 (G); right = 2.0 (A).

60–120 × 16–20 μm, basal cells quadrate. Dioicous. Setae 20–25 mm long, red. Capsules 5–6 mm long, cylindrical, constricted at neck, erect; annulus not seen, opercula not seen; peristome badly eroded, only remnants of exostome and endostome present. Calyptrae not seen. Spores 10–16 μm, spherical, smooth to lightly roughened.

Habitat. On tree trunks and branches; 1800–1950 m.

Brachymenium debilinerve is a large *Brachymenium* species very similar to *B. speciosum* (Hooker f. & Wilson) Steere. Both differ from all other Central American species of *Brachymenium* by the combination of their large size, extremely long leaf cells, and occasionally, doubly toothed leaf margins. *Brachymenium debilinerve* is marked by its dark green color, weak costa, well-spaced, flat, caducous leaves having numerous quadrate alar cells, and a very weakly developed limbidium. In contrast, *B. speciosum* is yellowish green, has percurrent to shortly excurrent costae, and closely spaced, persistent leaves with rectangular alar cells that are distinctively bordered by 3–4 rows of linear, thick-walled cells. *Brachymenium debilinerve* is known from Costa Rica (Guanacaste: *Dauphin 1833* (CR, MO); Puntarenas: *Dauphin 1454* (CR, MO)) and Panama.

Brachymenium exoticosporum B. H. Allen, sp. nov. TYPE: Panama. Chiriquí and Bocas del Toro: ridge top N of Cerro Pate Macho, ca. 5 km NE of Boquete above Palo Alto area, 8°48′N, 82°24′W, 1950–2200 m, *Hammel, Grayum, McPherson & Smith 14404* (holotype, MO; isotype, PMA). Figure 2A–I.

Species protonematibus endosporis grandibus linearibus, setisque longissimis a congeneribus differt.

Plants medium to large, yellowish green, shiny, in loose, open tufts, tomentose below. Stems to 30 mm long, epidermal cells rectangular, rhizoids reddish brown, papillose. Leaves distantly spaced and equally foliate, 3–5 mm long, flexuous-spreading when dry, erect-spreading when wet, concave, oblong-elliptic to ovate, acuminate, ending in denticulate points, margins distinctly bordered by several rows of linear, thick-walled cells, entire below, serrate to denticulate above, teeth single or occasionally double, reflexed at base, plane above; costa tapering to the apex, shortly excurrent into the hairpoint; cells firm-walled throughout, porose, upper cells long-rhomboidal, 40–70 × 20–24 μm, basal cells rectangular, 30–50 × 16–20 μm. Perichaetial leaves strongly differentiated, triangular-lanceolate to lanceolate, 5 mm long. Dioicous. Setae to 65 mm long, yellowish red to orange. Capsules to 7 mm long, cupulate, neck to 3 mm long, abruptly constricted, erect; operculum not seen; exostome teeth linear-lanceolate, red below, whitish above, densely papillose, endostome whitish, papillose, basal membrane short, segments and cilia rudimentary to absent. Calyptrae not seen. Spores 40–56 μm, thin-walled, oblong, lightly roughened. Endosporic protonemata filling the capsule, linear, multicellular, mostly uniseriate, 240–320 μm × 50–60 μm.

Habitat. Epiphyte on tree branches in forest on ridge; 1950–2200 m.

Brachymenium exoticosporum, known only from the type, is a robust species with distantly spaced, flexuous leaves that are distinctly bordered and sharply serrate; the marginal teeth at times are double. In its distantly spaced leaves it resembles *B. debilinerve* but that species has flat leaves, a short costa (½–⅔ the leaf length) and very weak to absent leaf limbidia. It is also gametophytically close to *B. speciosum*, but that species differs in its longer leaf cells (80–120 μm long). The outstanding features of *B. exoticosporum* are found in the unusually large size of its sporophytes and its massive endosporic protonemata. Although the spores of *B. exoticosporum* are also large, there are several *Brachymenium* species that have spores nearly as big (*B. consimile* (Mitten) Jaeger, 20–30 μm; *B. radiculosum* (Schwaegrichen) Hampe, 22–30 μm; *B. spirifolium* (C. Müller) Jaeger, 30–40 μm), and one species (*B. standleyi* Bartram, 20–80 μm) has larger spores. There are relatively few spores in the capsules of *B. exoticosporum*, and many of these appear inviable because they have collapsed spore walls. Most of the capsule contents consist of large, linear, multicelluar structures that represent enodosporically germinated protonemata. This is the first report of massive, endosporic protonemata in *Brachymenium*. The endosporic protonemata have mostly vertical end-walls. Occasionally these structures have horizontal or oblique walls, and sometimes they are irregularly rounded with cell walls in all planes.

Endosporically germinated protonemata are a rare feature randomly distributed among mosses. Allen (1987) postulated that these structures may be ecologically adaptive since they have been found to shorten the time between diaspore release and leafy gametophyte formation. Most endosporic protonemata are more or less globose and/or multiseriate in structure. The endosporic protonemata of *B. exoticosporum* resemble more or less uniseriate gemmae and appear similar to the type found

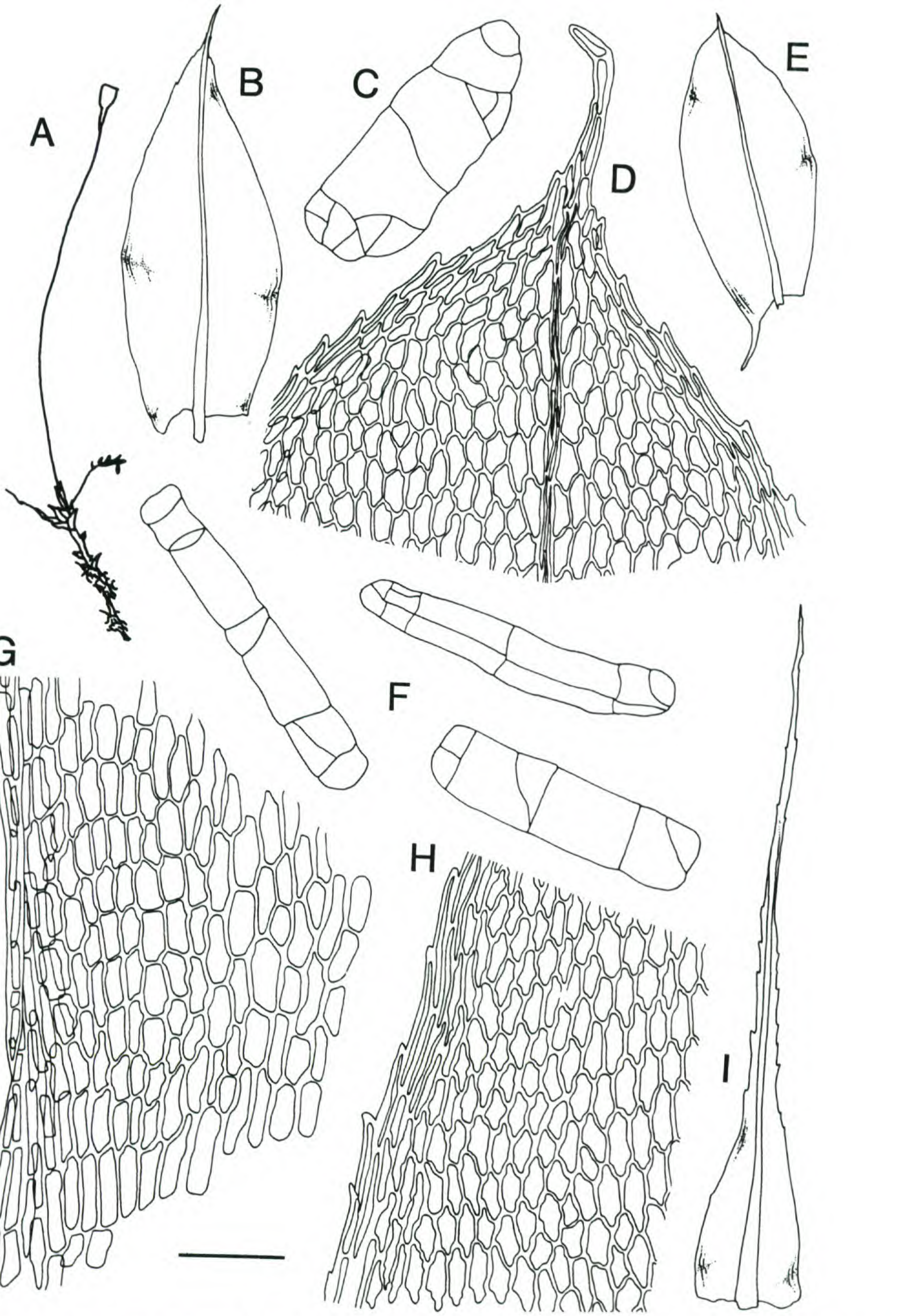


Figure 2. *Brachymenium exoticosporum* B. H. Allen. —A. Habit. —B & E. Vegetative leaves. —C & F. Endosporic protonemata. —D. Leaf apex and upper leaf cells. —G. Basal cells in alar region. —H. Leaf margin and median leaf cells. —I. Perichaetial leaf. Scale in mm: = 0.1 (C, D, F, G, H); = 0.5 (I); = 1.0 (B, E). Habit (A) drawn full-sized.

in *Ephemeropsis trentepohlioides* (Renner) Sainsbury (Sainsbury, 1955).

Key the Species of *Brachymenium* in Central America

1. Plants minute; leaves less than 1.0 mm long 2
1. Plants small to large; leaves greater than 1.2 mm long 3
2(1). Leaf cells lax and thin-walled throughout, upper cells elongate, alar cells short rectangular; leaves bordered by long, narrow cells . . . . . *B. acuminatum* Harvey
2. Leaf cells firm and thick-walled throughout, upper cells rhombic, alar cells quadrate; leaves bordered by short-rectangular cells . . . . . *B. exile* (Dozy & Molkenboer) Boch & Lacoste
3(1). Leaves caducous; costa from ½–⅔ the leaf length . . . . . *B. debilinerve* B. H. Allen
3. Leaves firmly attached to stem; costa percurrent to excurrent 4
4(3). Leaves not or indistinctly bordered 5
4. Leaves distinctly bordered 9
5(4). Leaves hair-pointed, the hair point entirely or in part hyaline, often ½–¾ the leaf length 6
5. Leaves cuspidate, the cuspid reddish, less than ⅕ the leaf length 8
6(5). Leaves with hair-point hyaline throughout, apical leaf cells linear, hyaline . . . . . *B. niveum* Bescherelle
6. Leaves with hair-point hyaline in upper half, reddish brown below, apical leaf cells hexagonal to rhomboidal-hexagonal, concolorous 7
7(6). Capsules narrowly cylindrical, 3–5 μm long; upper leaf margins toothed to sharply serrate or denticulate . . . . . *B. morascium* Bescherelle
7. Capsules obovate-oblong, 2.5–4 mm long, upper leaf margins entire to weakly serrulate . . . . . *B. systylium* (C. Müller) Jaeger
8(5). Leaves ovate to oblong-lanceolate, 1.4–2.3 mm long; basal leaf cells quadrate to subquadrate; plants without axillary bulbils; capsules cylindrical, endostome cilia/segments rudimentary or absent . . . . . *B. mexicanum* Montagne
8. Leaves ovate, lanceolate, or elongate-triangular, 2–3 mm long; basal leaf cells short-rectangular to subquadrate; plants often with axillary bulbils; capsules globose, endostome cilia/segments well developed, opposite the exostome teeth . . . . . *B. columbicum* (De Notaris) Brotherus
9(4). Basal leaf cells quadrate 10
9. Basal leaf cells rectangular 12
10(9). Leaves twisted around the stem, shortly and stoutly awned, awn reddish throughout, to 0.2 mm long; leaf border often of narrow rectangular cells with ± right-angled end-walls (occasionally with tapered end-walls); upper leaf margins crenulate to serrulate; leaf margins often narrowly reflexed . . . . . *B. klotzschii* (Schwaegrichen) Paris
10. Leaves imbricate, hair-pointed, the hair point hyaline throughout or hyaline above, reddish below, 0.5–1 mm long; leaf border of linear cells with long tapered end-walls; upper leaf margins toothed or sharply serrate to denticulate; leaf margins plane above 11
11(10). Leaves with hair-point hyaline throughout, apical leaf cells linear, hyaline . . . . . *B. niveum* Bescherelle
11. Leaves with hair-point hyaline in upper half, reddish brown below, apical leaf cells hexagonal to rhomboidal-hexagonal, concolorous . . . . . *B. morascium* Bescherelle
12(9). Setae to 65 mm long; capsules to 7 mm long; capsules with unicellular spores (40–56 μm) and linear, multicelluar, endosporic protonemata (240–320 × 56 μm) . . . . . *B. exoticosporum* B. H. Allen
12. Setae to 30 mm long; capsules to 5 mm long; spores unicellular (10–80 μm), multicellular, endosporic protonemata absent 13
13(12). Plants large, to 30–40 mm long; leaves flexuous and appressed to stem when dry, oblong to oblong-lanceolate; upper leaf cells 80–120 μm long . . . . . *B. speciosum* (Hooker f. & Wilson) Steere
13. Plants medium, to 15 mm long; leaves spirally contorted or crisped and contorted when dry, elongate-oblong, obovate-oblong to spathulate (rarely oblong-lanceolate); upper leaf cells 30–60 μm long 14
14(13). Leaves crisped and contorted when dry, often orbicular, obtuse to shortly and broadly acuminate . . . . . *B. wrightii* (Sullivan) Brotherus
14. Leaves spirally twisted when dry, variously lanceolate, oblong, obovate-oblong, spathulate, acute to acuminate 15
15(14). Leaf margins nearly entire to finely serrulate at the apex; operculum high-conic and obliquely beaked; exostome teeth linear . . . . . *B. spirifolium* (C. Müller) Jaeger
15. Leaf margins sharply serrulate or denticulate in upper ⅓; operculum conic to conic-apiculate; exostome teeth linear-lanceolate to lanceolate 16
16(15). Exostome teeth broadly lanceolate, united at base; endostome segments and cilia rudimentary or with endostomal material adhering in patches to the upper parts of the exostome teeth . . . . *B. consimile* (Mitten) Jaeger
16. Exostome teeth linear-lanceolate, free at base; endostome segments absent, rudimentary, or well developed 17
17(16). Endostome segments rudimentary or absent;

spores irregular in shape, spherical, ovoid, or oblong, 20–80 μm . . . . . *B. standleyi* Bartram

17. Endostome segments well developed, linear with narrow perforation gaps; spores spherical, 22–30 μm . . . . . *B. radiculosum* (Schwaegrichen) Hampe

Acknowledgment. This work was supported by National Science Foundation Grant DEB-9400996 (to the Missouri Botanical Garden).

Literature Cited

Allen, B. H. 1987. Observations on the protonemata of *Drummondia prorepens* (Musci: Orthotrichaceae). Evansia 4: 33–37.

———. 1994. Moss Flora of Central America. Part 1, Sphagnaceae–Calymperaceae. Monogr. Syst. Bot. Missouri Bot. Gard. 49: 1–242.

Ochi, H. 1980. A revision of the neotropical Bryoideae, Musci (First Part). J. Fac. Educ. Tottori Univ., Nat. Sci. 29: 49–154.

———. 1992. A revised infrageneric classification of the genus *Bryum* and related genera (Bryaceae, Musci). Bryobrothera 1: 231–244.

Sainsbury, G. O. K. 1955. A Handbook of the New Zealand Mosses. Bull. Roy. Soc. New Zealand 5: 1–490.

Shaw, J. 1984. A reinterpretation of peristome structure in *Pseudoditrichum mirabile* Steere & Iwats. (Pseudoditrichaceae). Bryologist 87: 314–318.

Five New Species of *Macromitrium* (Musci: Orthotrichaceae), with a Key to the Species of *Macromitrium* in Central America

Bruce Allen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Macromitrium crosbyorum* sp. nov., *M. echinatum* sp. nov., *M. frustratum* sp. nov., *M. picobonitum* sp. nov., and *M. sejunctum* sp. nov. are described based on Central American material. A key to the species of *Macromitrium* in Central America is given. The 30 Central American species of *Macromitrium* are arranged into 7 informal groups.

Macromitrium is a sizable genus, about 350–400 species, of medium- to large-sized pleurocarpous mosses. The last treatment of the genus that included Central America was Grout (1946), which attributed 24 species to the region. The genus is often found on upper tree branches in the forest canopy, but it also commonly occurs on tree trunks and can be found on rocks and soil in open, drier habitats. Most *Macromitrium* species have elimbate leaves with short upper leaf cells and elongate to linear, tuberculate basal leaf cells, mitrate calyptrae, and short, truncate exostome teeth that are fused for most of their lengths. However, the genus is morphologically complex, and there are *Macromitrium* species with various combinations of limbate leaves, long upper leaf cells, short basal leaf cells, non-tuberculate basal cells, cucullate calyptrae, and long, narrowly triangular, non-fused exostome teeth. As a result, the genus is difficult to characterize or cleanly separate from a number of segregate genera (e.g., *Groutiella, Macrocoma, Cardotiella*) recognized for groups of species with short basal leaf cells in combination with some other distinctive feature.

Vitt (1994) recognized three distinctive groups for the 10 *Macromitrium* species in Mexico. The 30 Central American *Macromitrium* species are more diversified and variable than those of Mexico. They include 5 species new to science, which are described below in preparation for the next volume of the *Moss Flora of Central America* (Allen, 1994).

Macromitrium crosbyorum B. H. Allen & Vitt, sp. nov. TYPE: Costa Rica. San José: along Inter American Highway, ca. 10 km NW of summit at La Ascension, 9°37′N, 83°48′W, *Crosby & Crosby 6089* (holotype, MO; isotypes, ALTA, CR, NY, US). Figure 1.

Species haec a *M. subcirroso* inter alia foliorum cellulis isodiametris, crasse unipapillosis costisque percurrentibus differt.

Plants large, greenish red to yellowish red. Stems creeping to 7 cm, branches 2–3 cm long, reddish tomentose below. Leaves keeled, erect below, flexuous to spirally contorted and undulate above dry, erect-patent wet, (3–)4–6 mm long, 1 mm wide, lanceolate, acuminate; margins undulate, serrate above, frequently serrulate to near the base, recurved below, erect to plane above, swollen basal teeth at leaf insertion absent; costae percurrent; upper interior cells 8–20 μm, rounded and collenchymatous, isodiametic to rhombic, stoutly unipapillose to mammillose, upper marginal cells narrow and elongate forming a ± distinct border, basal cells long rectangular, incrassate and porose, densely tuberculate, 26–44 μm long. Dioicous. Setae 7–10 mm long, smooth. Capsules 1.5–2.0 mm long, ovoid to cylindrical, plicate. Annulus non-revoluble, with fragments adhering to capsule mouth. Exostome teeth truncate, 320–424 μm high, yellow, densely papillose-striate, united and forming a membrane, ± reflexed at tips, splitting into eight pairs of teeth with age; endostome hyaline, lightly papillose, basal membrane 80–90 μm high, segments 60–80 μm high. Opercula rostrate, 1–1.5 mm long. Spores anisosporous, 14–20 μm, smooth to lightly papillose and 30–48(–54) μm, densely papillose. Calyptrae mitrate, deeply laciniate, naked, 5 mm long.

Habitat. On tree trunks, logs, and rocks; 3130–3333 m.

Macromitrium crosbyorum is a large moss with undulating leaves and isodiametric, collenchymatous, mammillose to stoutly unipapillose upper leaf cells. It has long, narrow marginal leaf cells that form a variably distinct border. *Macromitrium subcirrosum* C. Müller differs from it in having elongated upper leaf cells, an excurrent costa, and elimbate leaves. *Macromitrium scoparium* Mitten is similar to *M. crosbyorum* in having limbate leaves, isodiametric upper leaf cells, and tuberculate basal leaf cells but differs in having smaller, narrower,

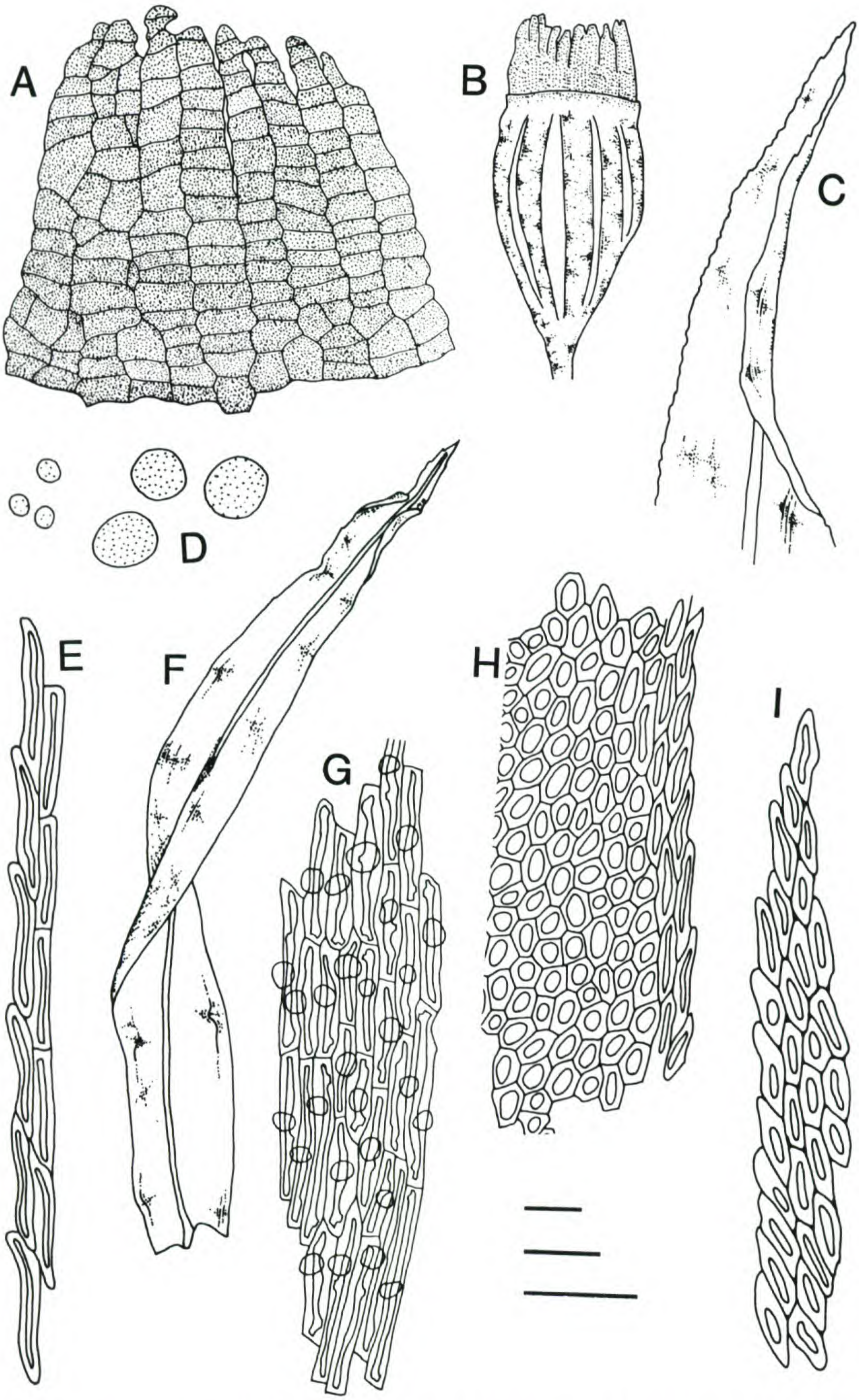


Figure 1. *Macromitrium crosbyorum* B. H. Allen & Vitt. —A. Exostome. —B. Capsule. —C. Leaf apex. —D. Spores. —E. Upper leaf margin. —F. Leaf. —G. Basal leaf cells. —H. Median leaf cells. —I. Apical leaf cells. Scales in mm: top = 0.5 (B); middle = 0.5 (F); bottom = 0.05 (A, D, E, G–I); bottom = 0.2 (C).

non-undulate leaves and smooth to weakly bulging upper leaf cells.

Some leaves of *M. crosbyorum* have weakly developed limbidia and could be confused with those of *M. cirrosum* (Hedwig) Bridel or *M. oblongum* (Taylor) Mitten. *Macromitrium crosbyorum* differs from both species in having broader, erect-patent, undulate leaves and stoutly unipapillose upper leaf cells. *Macromitrium cirrosum* further differs from it in having smooth capsules and upper leaf cells in distinct longitudinal rows.

Paratypes. COSTA RICA. **San José:** summit of Pan American Highway at Cerro de la Muerte, 9°30′N, 83°45′W, *Crosby 3906* (MO). PANAMA. **Bocas del Toro:** Cordillera de Talamanca, 2 airline km SW of the main peak of Cerro Fábrega along the NW ridge of the massif, 9°08′N, 82°53′W, *Davidse et al. 25327* (CR, MICH, MO, NY, PMA, US).

Macromitrium echinatum B. H. Allen, sp. nov. TYPE: Panama. Bocas del Toro: vicinity of Fortuna Dam, 2.8 road-miles along pipeline road leaving Chiriquí Grande road at Continental Divide, 8°55′N, 82°08″W, *Allen 5655* (holotype, MO; isotype, PMA). Figure 2.

Species haec a *M. fuscoaureo* inter alia foliis torsivis, non-amplectibus, limbatis, exostomatum dentibus 16, lanceolatis, libris, calyptrisque hirsutis differt.

Plants large, yellowish green above, brown below. Stems weakly creeping, branches to 5 cm long, weakly tomentose. Leaves keeled, erect to erect-flexuous below, tightly spirally twisted and undulate above when dry, squarrose-spreading to squarrose-recurved when wet, 7–10 mm long, 0.8–1 mm wide, linear-lanceolate, setaceous-acuminate; margins revolute at base, plane above, sharply serrate in upper ½, swollen basal teeth at leaf insertion absent; costae long excurrent; upper interior cells 28–50 μm × 10 μm, linear-rhomboidal, incrassate and porose, smooth, upper marginal cells longer and narrower forming a ± distinct border, basal cells not tuberculate, to 66 μm long, linear-rectangular to linear-rhomboidal, incrassate and porose. Dioicous. Setae 5–6 mm long, smooth. Capsules 2 mm long, oval to oblong-cylindrical, smooth or weakly furrowed when dry, wrinkled at neck. Annulus non-revoluble, with fragments adhering to capsule mouth. Exostome teeth narrowly triangular, 280 μm high, separate except at base where they are united into a short membrane 60 μm high, red-yellow, thickly papillose; endostome rudimentary, 120–160 μm high, basal membrane low, segments yellowish-hyaline, weakly papillose. Opercula erect-rostrate, 1 mm long. Spores anisosporous, 20–28 μm, round, nearly smooth, thin-walled and 36–50, irregularly oblong, oval, or rounded, lightly papillose, thick-walled. Calyptrae mitrate, deeply laciniate, densely hirsute, 3–4 mm long.

Habitat. On tree trunks, upper branches, and occasionally on ground; 850–1150 m.

Macromitrium echinatum is a robust moss with non-clasping, spirally twisted, limbate leaves, long, incrassate, and porose upper leaf cells, non-tuberculate basal leaf cells, densely hairy calyptrae and 16 separate, narrowly triangular exostome teeth that are divided most of their lengths. The only other Central American species with free exostome teeth, *M. greenmanii,* has shorter, elimbate leaves, tuberculate basal leaf cells, isodiametric upper leaf cells, furrowed capsules, papillose setae, and naked calyptrae.

This species is close to *M. fuscoaureum* Bartram, which differs in having weakly serrate leaves that are erect and tightly clasping at base, longer setae, and naked calyptrae. The intact peristome of *M. fuscoaureum* is unknown.

Paratypes. PANAMA. **Bocas del Toro:** Fortuna Dam region, along pipeline service road, 8°45′N, 82°15′W, trail in forest, *McPherson 7846G* (MO); vicinity of Fortuna Dam, 2.8 road-miles along pipeline road leaving Chiriquí Grande road at Continental Divide, 8°55′N, 82°08″W, *Allen 5688* (DUKE, H, MICH, MO, NY, PMA, US).

Macromitrium frustratum B. H. Allen, sp. nov. TYPE: Honduras. Lempira: Montana de Celaque, summit of Cerro la Castilla, ca. 12 km SW of Gracias, 14°33′N, 88°41′W, on trunk of *Pinus, Allen 11542* (holotype, MO; isotypes, DUKE, H, MICH, NY, TEFH, US). Figure 3.

Species haec a *M. longifolio* inter alia foliorum apicibus longis, fragilibus setisque laevibus differt.

Plants robust, greenish yellow to greenish brown. Stems strongly creeping, branches 5 cm long, moderately tomentose. Leaves keeled, erect below, flexuous to spirally twisted and undulate above when dry, erect-patent to erect-spreading when wet, 4–7 mm long, 0.5 mm wide, linear-lanceolate, long-acuminate into a fragile apex up to 3 mm long; margins plane to undulating, entire to serrulate below, serrate above with one to several large, multicellular teeth on the leaf acumen, swollen basal teeth at leaf insertion absent, recurved below, erect to plane above; costa percurrent to shortly excurrent; upper interior cells 6–12 × 6–8 μm, quadrate to rounded, incrassate not porose, smooth to weakly bulging, in distinct longitudinal rows, upper marginal cells at times longer and narrower than interior cells forming a weakly differentiated border; basal cells

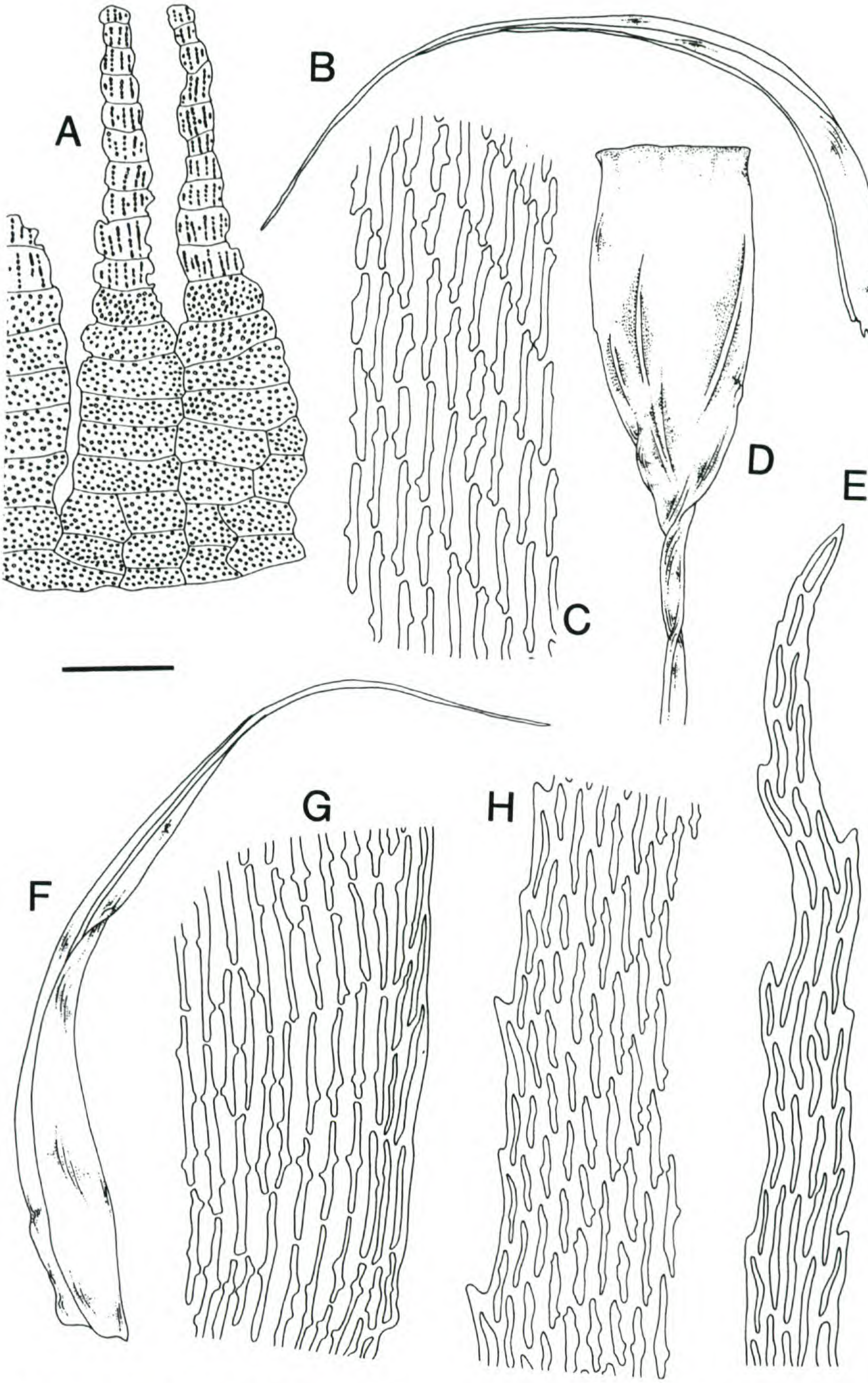


Figure 2. *Macromitrium echinatum* B. H. Allen. —A. Exostome. —B & F. Leaves. —C. Basal cells near the costa. —D. Capsule. —E. Leaf apex. —G. Basal cells at leaf margin. —H. Upper leaf cells at margin. Scale in mm: = 0.05 (A, C, E, G, H); = 0.5 (D); = 1.0 (B, F).

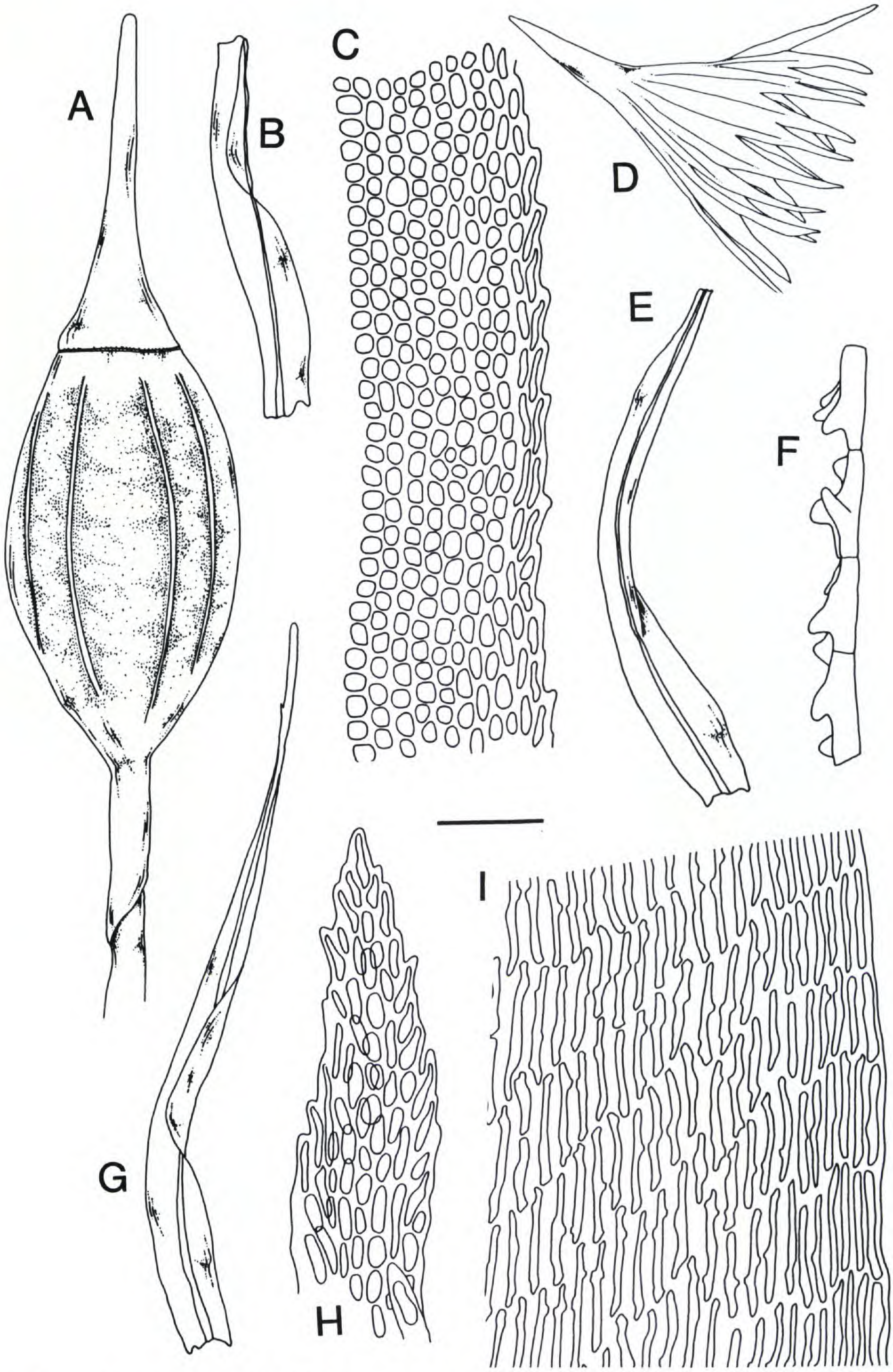


Figure 3. *Macromitrium frustratum* B. H. Allen. —A. Capsule and operculum. —B, E & G. Leaves. —C. Leaf margin and median leaf cells . —D. Calyptra. —F. Tuberculae leaf cells seen on edge. —H. Leaf apex and apical leaf cells. —I. Leaf margin and basal leaf cells. Scale in mm: = 0.05 (C, F, H, I); = 0.5 (A); = 1.0 (D); = 0.91 (B, E, G).

weakly tuberculate, 24–40 μm long, long-rectangular, incrassate and porose. Dioicous. Setae 5–8 mm long, smooth; capsules 2–3 mm long, cylindrical, furrowed; annulus non-revoluble, with fragments adhering to capsule mouth; opercula rostrate, 1–1.5 mm long; exostome teeth truncate, 240 μm high, yellow, densely papillose, fused into an erect membrane at base ± free at tips, endostome hyaline, weakly papillose, basal membrane 160 μm high, segments 80 μm high. Spores anisosporous, 10–14 μm, smooth, hyaline and 18–30 μm, papillose, yellow-brown. Calyptrae mitrate, deeply laciniate, naked, 3 mm long.

Habitat. On tree trunks and branches; 1676–2827 m.

Macromitrium frustratum is a robust species with linear-lanceolate leaves and long (up to 3 mm), fragile apices. It is a high-elevation, cloud forest species very similar to and often occurring mixed with *M. longifolium* (Hooker) Bridel. *Macromitrium longifolium*, however, has intact leaf apices and papillose setae. *Macromitrium frustratum* has leaf cells in distinct longitudinal rows, a feature also found in *M. cirrosum*, with which it has been confused. *Macromitrium cirrosum* is a smaller plant with intact leaf apices and smooth capsules.

Macromitrium picobonitum B. H. Allen, sp. nov. TYPE: Honduras. Atlántida: El Porvenir, Pico Bonito National Park, along trail at and above ridge camp, 15°38′N, 86°52′W, *Allen 17488* (holotype, MO; isotype, TEFH). Figure 4.

Species haec a *M. cirroso* apicibus foliorum longis hyalinisque cellulis superis marginalibus longis angustis differt.

Plants medium, green to greenish yellow above, brown below. Stems creeping, branches 15 mm long, moderately tomentose. Leaves keeled, erect below, flexuous to spirally twisted and undulate above when dry, erect-patent to erect-spreading when wet, 3–6 mm long, 0.5 mm wide, linear-lanceolate, long-acuminate into a hyaline hair-tip; margins plane to undulating, entire to serrulate below, serrate above, swollen basal teeth at leaf insertion absent, recurved below, erect to plane above; costa excurrent to 360 μm; upper interior cells 6–14 × 6–8 μm, rounded to short-rectangular, incrassate not porose, bulging mammillose, in distinct longitudinal rows, upper marginal cells often longer and narrower than interior cells forming a weakly differentiated border; basal cells tuberculate, 25–50 μm long, long-rectangular, incrassate and porose. Dioicous. Setae 5 mm long, smooth; capsules 1–2 mm long, cupulate to hemispheric, smooth or weaky furrowed at neck; annulus non-revoluble, with fragments adhering to capsule mouth; opercula rostrate, 1 mm long; exostome teeth truncate, 160 μm high, orange, densely papillose, fused into an erect membrane at base ± free at tips, endostome yellowish to hyaline, weakly papillose, projecting beyond the exostome. Spores anisosporous, 14–18 μm, and 20–30 μm, smooth to lightly papillose, yellow-brown. Calyptrae mitrate, deeply laciniate, naked, 3 mm long.

Habitat. On tree fern, trunks of *Liquidambar*, and small trees or shrubs; 1500–1630 m.

Macromitrium picobonitum is very close to *M. cirrosum*. The species are sporophytically identical, but *M. cirrosum* differs gametophytically from *M. picobonitum* in having a shorter, concolorous, excurrent costa and shorter upper marginal cells that only very rarely form an indistinct border. These two species are the smallest members of a species complex that includes *M. longifolium*, *M. frustratum*, and *M. oblongum*. All three species differ from *M. picobonitum* and *M. cirrosum* in having strongly furrowed capsules. In addition, *M. longifolium* has papillose setae, *M. frustratum* long, fragile leaf apices, and *M. oblongum* swollen basal marginal teeth and exostome teeth 280–300 μm high. *Macromitrium scoparium* may also belong to this complex. As in *M. picobonitum*, *M. scoparium* has a variously developed leaf border of narrow, elongated cells, but it differs in having longer upper leaf cells and concolorous leaf apices.

Paratypes. HONDURAS. **Atlántida:** El Porvenir, Pico Bonito National Park, along trail from confluence to ridge camp, 15°38–39′N, 86°51–52′W, *Allen 17366, 17370, 17373* (all MO, TEFH).

Macromitrium sejunctum B. H. Allen, sp. nov. TYPE: Honduras. Olancho: Sierra de Algalta, La Chorrerra below Montana Bibilonia, Rio Lara, 15 km NNW of Catacamas, 14°59′N, 85°56′W, *Allen 12483* (holotype, MO; isotypes, NY, TEFH). Figure 5.

Species cellulis costalibus brevibus mamillatis, cellulis basalibus brevibus, marginibus foliorum erosis dentatisque apicibus foliorum fragilibus a congeneribus diversa.

Plants medium, dark green. Stems moderately creeping, branches 1.5–2.5 cm long, tomentose below. Leaves weakly keeled, erect below, flexuous to spirally contorted above dry, erect-patent and undulate when wet, 2–3 mm long, 0.8 mm wide, lanceolate, broadly acute, or acuminate into a fragile

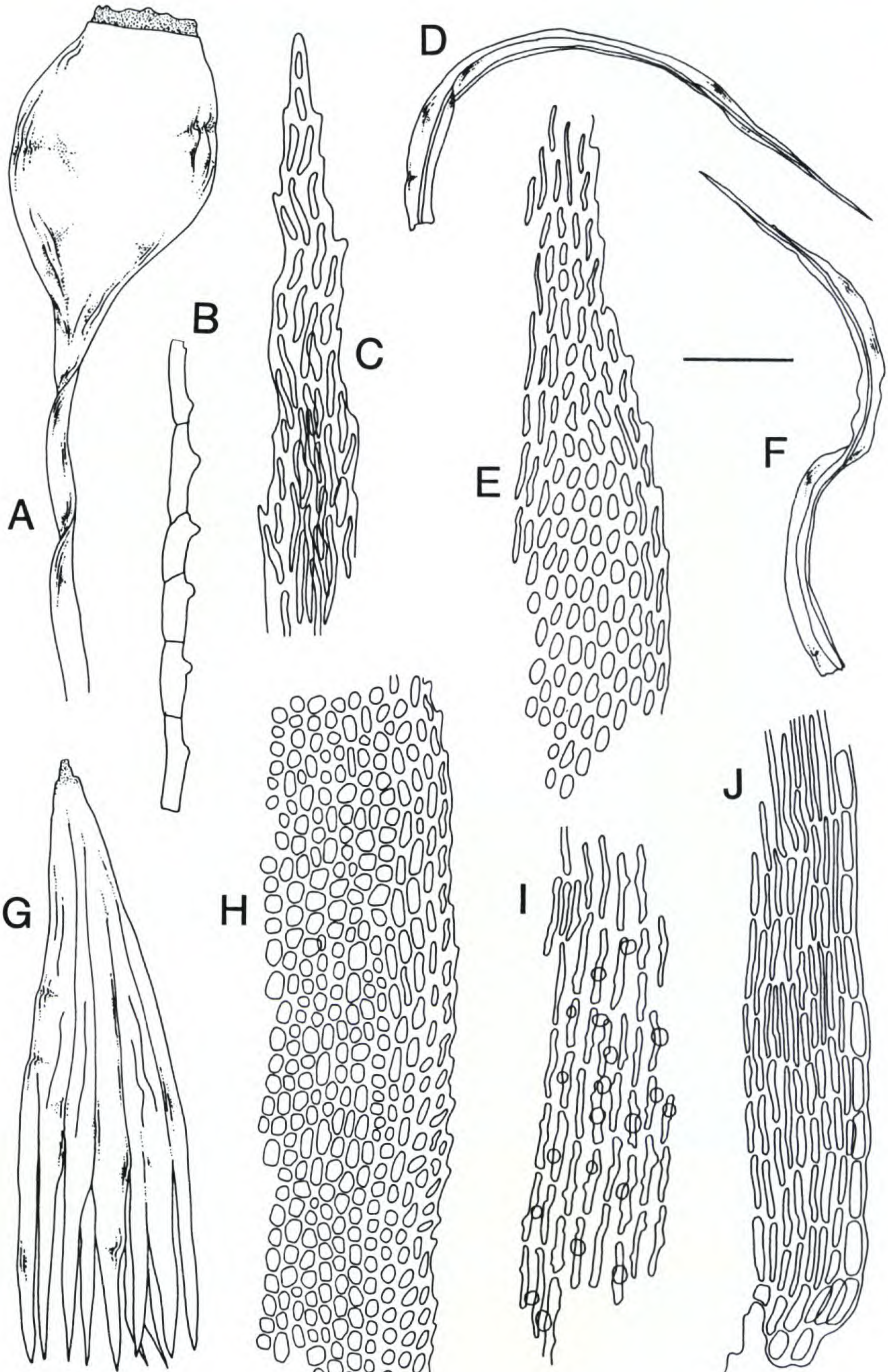


Figure 4. *Macromitrium picobonitum* B. H. Allen. —A. Capsule. —B. Tuberculate leaf cells seen on edge. —C. Leaf apex. —D & F. Leaves. —E. Upper leaf cells at base of acumen. —G. Calyptra. —H. Median leaf cells. —I. Basal leaf cells near costa. —J. Basal leaf cells at margin. Scale in mm: = 0.5 (B, C, E, H, I, J); = 0.5 (A, G); middle = 0.91 (D, F).

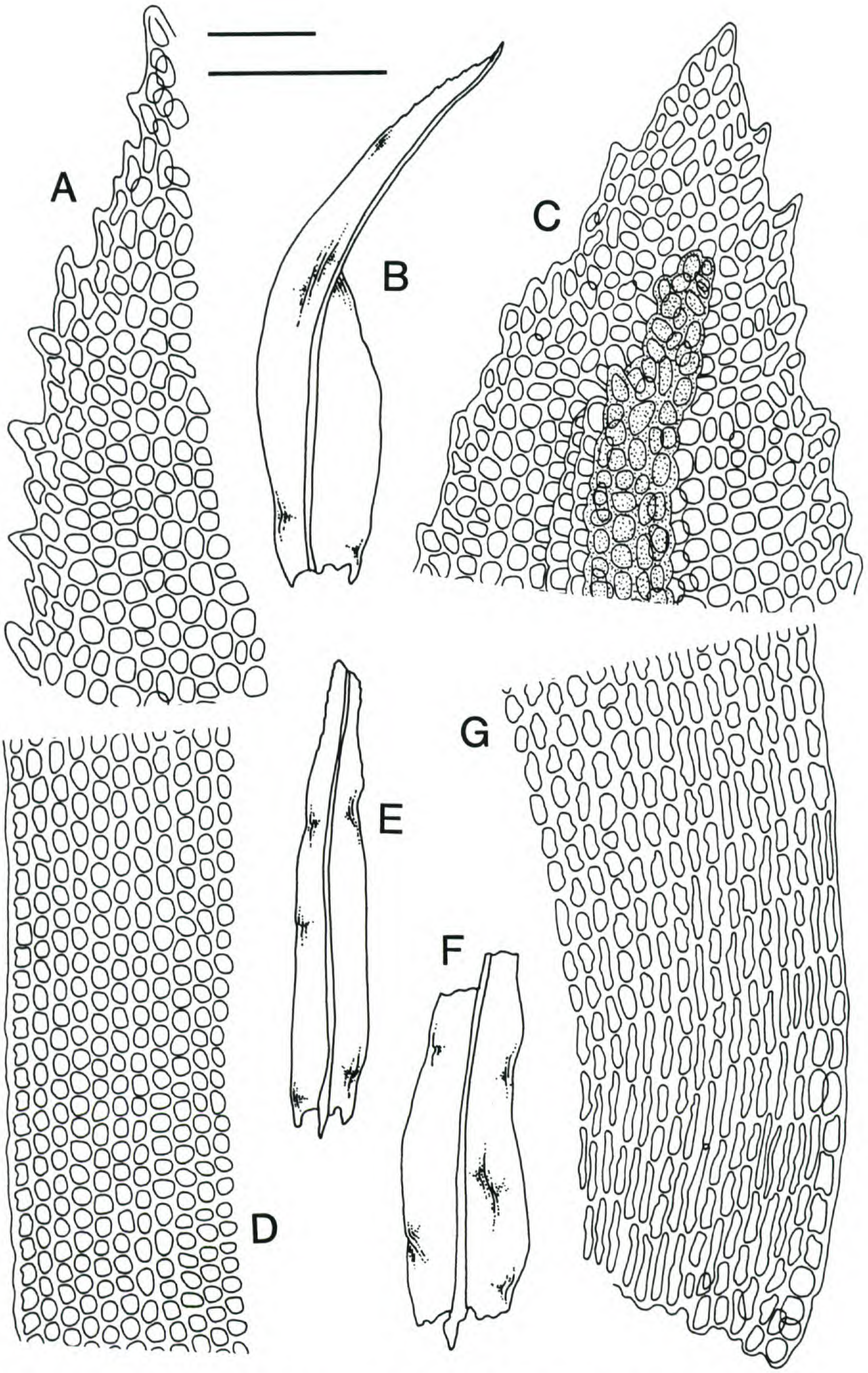


Figure 5. *Macromitrium sejunctum* B. H. Allen. —A. Upper leaf margin and cells. —B, E & F. Leaves. —C. Leaf apex and upper leaf cells. —D. Median leaf margin and cells. —G. Basal leaf margin and cells. Scales in mm: top = 0.05 (A, C, D, G); bottom = 1.0 (B, E, F).

leaf tip; margins erose-dentate above, swollen basal teeth at leaf insertion absent, but commonly with rhizoids from basal marginal cells, recurved below, plane above; costa ending below the apex to percurrent, dorsal surface covered in upper ⅓ by rounded, mammillose cells; upper interior cells 8–12 μm, firm-walled hexagonal, smooth to mammillose, upper marginal cells not differentiated; basal cells not or weakly tuberculate, short, 20–28 μm long at the extreme base, rectangular, incrassate, not or weakly porose. Sporophyte unknown.

Habitat. On branch in dry forest; 1100–1500 m.

Macromitrium sejunctum is marked by its fragile leaf apices, erose-dentate upper leaf margins, dorsal costal surface in upper ⅓ covered by short, mammillose cells, and short basal cells that lack tuberculae or have a few very weak tuberculae. It has the general aspect of *M. punctatum* (Hooker & Greville) Bridel, and that species also has short, non-tuberculate basal leaf cells, but *M. punctatum* has firm leaf apices, serrate leaf margins, and elongate cells on the upper dorsal surface of the costa. There are two other species of *Macromitrium* in Central America with fragile leaf apices (*M. fragilicuspis* Cardot and *M. frustratum*); both have elongate, more strongly tuberculate basal leaf cells. *Macromitrium fragilicuspis* also has entire leaf margins, while *M. frustratum* is a larger plant with narrowly lanceolate leaves (to 7 mm) and elongate cells on the dorsal surface of the costa. In leaf form, cellular aereolation, and the mammillose cells on the dorsal surface of the costa, *M. sejunctum* resembles *Cardotiella*; it differs from that genus in lacking enlarged, basal marginal teeth.

Groutiella chimborazense (Spruce ex Mitten) Florschütz subsp. *reesei* Vitt is also similar in having fragile leaf apices, short basal leaf cells, and the upper dorsal surface of the costa covered by short, mammillose cells. In addition, the leaves of *G. chimborazense* subsp. *reesei* are bordered at the base by a single row of short-rectangular, thin-walled cells that are identical to those found in *Macromitrium sejunctum*. *Groutiella chimborazense* subsp. *reesei* differs from *M. sejunctum* in having upper leaf margins entire or bulging mammillose rather than erose-dentate.

Paratypes. HONDURAS. **Atlántida:** El Porvenir, Pico Bonito National Park, along trail from confluence to ridge camp, 15°38–39′N, 86°51–52′W, *Allen 17367* (MO, TEFH).

As would be expected from such a species-rich genus, *Macromitrium* has many distinctive characters. However, it is difficult to subdivide the genus, because its character states occur in reticulating combinations, making it impossible to find any significant correlation of characters. The 30 *Macromitrium* species in Central America are arranged below into 7 informal groups that bring together species that share at least one of seven distinctive features (Table 1). The groups are intended to help in the handling of this large genus and may or may not represent monophyletic units.

Group 1. *Macromitrium leprieurii* Montagne and *M. dubium* Schimper ex C. Müller.

Group 2. *Macromitrium flavopilosum* Williams, *M. standleyi* Bartram, *M. subcirrosum* C. Müller, *M. trichophyllum* Mitten, and *M. ulophyllum* Mitten.

Group 3. *Macromitrium altituberculosum* Bartram, *M. contextum* Hampe, *M. fragilicuspis* Cardot, *M. guatemalense* C. Müller, *M. oblongum* (Taylor) Mitten, and *M. podocarpi* C. Müller.

Group 4. *Macromitrium microstomum* (Hooker & Greville) Schwaegrichen and *M. richardii* Schwaegrichen.

Group 5. *Macromitrum aureum* C. Müller, *M. cirrosum* (Hedwig) Bridel, *M. frustratum* B. H. Allen, *M. greenmanii* Grout, *M. longifolium* (Hooker) Bridel, *M. parvirete* Bartram, *M. picobonitum* B. H. Allen, and *M. sharpii* Crum ex Vitt.

Group 6. *Macromitrium crosbyorum* B. H. Allen & Vitt, *M. echinatum* B. H. Allen, *M. fulgescens* Bartram, *M. fuscoaureum* Bartram, and *M. scoparium* Mitten.

Group Incertae. *Macromitrium punctatum* (Hooker & Greville) Bridel and *M. sejunctum* B. H. Allen.

Key to the Species of *Macromitrium* in Central America

1. Leaf apices fragile, commonly broken 2
1. Leaf apices not fragile or commonly broken 4

2(1). Leaf apices abruptly rounded and narrowed to the acumens, margins entire or evenly crenulate, basal cells strongly tuberculate at base . . . . . *M. fragilicuspis* Cardot

2. Leaf apices gradually narrowed to the acumens, margins serrate, serrulate, or erose-dentate; basal cells not or weakly tuberculate at base 3

3(2). Leaves 2–3 mm long, erose-dentate above; basal leaf cells rectangular, non-porose, upper dorsal surface of costa with short, mammillose cells . . . . . *M. sejunctum* B. H. Allen

3. Leaves 4–7 mm long, serrulate to serrate above; basal leaf cells linear, porose; dorsal surface of costa with long, smooth cells . . . . . *M. frustratum* B. H. Allen

4(1). Upper leaf cells porose; all cells greater than 2:1 5

4. Upper leaf cells not porose; most cells less than 2:1 14

5(4). Leaves 10–15 mm long 6

Table 1. Distinguishing features of the *Macromitrium* groups. Character states: *plant size*, s small, m medium, l large; *leaf border*, + present, − absent; *upper leaf cells*, lin linear, e elongate, iso isodiametric; *basal leaf cells*, lin linear, s short rectangular; *swollen teeth on basal margin*, + present, − absent; *calyptra*, m mitrate, c cucullate; *capsules*, p puckered, x smooth or furrowed.

Groups	1	2	3	4	5	6	Incertae
Plant size	l	l	l,m,s	m,s	l,m	m	m
Leaf border	−	−	−	−	−	+	−
Upper leaf cells	lin	e	iso	iso	iso	iso,e	iso
Basal leaf cells	lin	lin	lin	lin	lin	lin	s
Basal margin	−	−	+	−	−	−	−
Calyptra	c	m	m	m	m	m	m
Capsules	x	x	x	p	x	x	x

5. Leaves 4–9(–10) mm long 7
   6(5). Leaves clasping at base, squarrose above; upper leaf margins serrate; basal leaf cells smooth . . . . . *M. trichophyllum* Mitten
   6. Leaves spreading at base; erect-spreading above; upper leaf margins ciliate-dentate; basal leaf cells tuberculate . . . . . *M. standleyi* Bartram
7(5). Costa long-excurrent into a naked awn 1–2 mm long . . . . . *M. flavopilosum* Williams
7. Costa percurrent or short excurrent 8
   8(7). Leaves broadly lanceolate, 0.4 mm or more wide ⅔ the distance from leaf base 9
   8. Leaves linear-lanceolate, 0.2–0.3 mm wide ⅔ the distance from leaf base 10
9(8). Leaves strongly undulate; basal cells weakly tuberculate or smooth . . . *M. ulophyllum* Mitten
9. Leaves smooth or weakly undulate; basal cells strongly tuberculate . . . . . *M. subcirrosum* C. Müller
   10(8). Basal leaf cells tuberculate . . . . . *M. scoparium* Mitten
   10. Basal leaf cells smooth 11
11(10). Leaves shortly acuminate to apiculate . . . . . *M. leprieurii* Montagne
11. Leaves long-acuminate to subulate 12
   12(11). Leaves plane above; costa ending well below apex . . . . . *M. dubium* Schimp ex C. Müller
   12. Leaves keeled above; costa percurrent or excurrent 13
13(12). Leaves clasping at base, squarrose above, weakly serrate; calyptrae naked; peristome teeth not known . . . . *M. fuscoaureum* Bartram
13. Leaves spreading at base, erect-spreading above, sharply serrate; calyptrae hairy; exostome of 16, deeply divided, narrowly triangular teeth . . . . . *M. echinatum* B. H. Allen
   14(4). Leaves erose-dentate above; upper dorsal surface of costa with short, mammillose cells . . . . . *M. sejunctum* B. H. Allen
   14. Leaves crenulate, serrulate, serrate, or dentate above; upper dorsal surface of costa with long, smooth cells 15
15(14). Basal leaf cells smooth 16
15. Basal cells tuberculate 20
   16(15). Upper marginal leaf cells longer and narrower than inner cells 17
   16. Upper leaf cells homogenous . . . 18
17(16). Leaves linear, 7–10 mm long . . . . . *M. fulgescens* Bartram
17. Leaves lanceolate, 4–6 mm long . . . . . *M. scoparium* Mitten
18(16). Upper leaf cells pluripapillose . . . . . *M. richardii* Schwaegrichen
   18. Upper leaf cells smooth, mammillose or stoutly unipapillose 19
19(18). Leaf cells linear in lower ½–⅔, margins entire, cells smooth; capsules puckered at mouth . . . . . *M. microstomum* (Hooker & Greville) Schwaegrichen
19. Leaf cells rectangular in lower ⅓, margins serrate to serrulate, cells mammillose to stoutly unipapillose; capsules smooth at mouth . . . . . *M. punctatum* (Hooker & Greville) Bridel
20(15). Most leaves 2 mm or less long . . 21
20. All leaves greater than 2 mm long 23
21(20). Leaves ligulate, obtuse-mucronate, plicate . . *M. altituberculosum* Bartram
21. Leaves oblong-lanceolate or lanceolate, obtuse-apiculate, apiculate, or cuspidate; not plicate 22
22(21). Leaves with basal cells strongly tuberculate, elongate cells only at outer portion of the leaf base, basal margins entire . . . . . *M. sharpii* Crum ex Vitt
22. Leaves with basal cells weakly tuberculate; elongate cells filling the lower one-third of the leaf, basal margins with swollen, hyaline teeth . . . . . *M. podocarpi* C. Müller
23(20). Upper marginal cells oblong to oblong-linear, longer and narrower than interior cells forming a ± distinct border 24
23. Upper marginal cells rounded to hexagonal-rounded, identical to the interior cells . . . 25
24(23). Leaves strongly undulate; upper cells mammillose to stoutly unipapillose; capsules furrowed . . . . . *M. crosbyorum* B. H. Allen & Vitt

24. Leaves not or weakly undulate; upper cells smooth or weakly bulging; capsules smooth . . *M. scoparium* Mitten

25(23). Leaf apices cuspidate; costa abruptly excurrent . . . . . *M. parvirete* Bartram

25. Leaf apices acute to acuminate; costa percurrent to gradually excurrent 26

26(25). Basal leaf margins with enlarged, hyaline teeth at insertion 27

26. Basal leaf margins entire or mammillose 29

27(26). Leaves linear-lanceolate, 4–6 mm long, apex long-acuminate . . *M. oblongum* (Taylor) Mitten

27. Leaves lanceolate, 2–3 mm long, apex acute 28

28(27). Leaves undulose, margins regularly serrate to serrulate, costa ending below apex; capsules furrowed dry; calyptra sparsely hairy to naked . . . . . *M. guatemalense* C. Müller

28. Leaves rugose, margins irregularly dentate, costa excurrent; capsules smooth to weakly and irregularly furrowed dry; calyptra naked . . . . . *M. contextum* Hampe

29(26). Setae smooth 30

29. Setae papillose 31

30(29). Capsules smooth . . . . . *M. cirrosum* (Hedwig) Bridel

30. Capsules furrowed . . . . . *M. aureum* C. Müller

31(29). Exostome of 16 short, truncate teeth . . . . . *M. longifolium* (Hooker) Bridel

31. Exostome of 16 narrowly triangular teeth . . . . . *M. greenmanii* Grout

Literature Cited

Allen, B. 1994. The Moss Flora of Central America. Part 1. Sphagnaceae–Calymperaceae. Monogr. Syst. Bot. Missouri Bot. Gard. 49: 1–242.

Grout, A. J. 1946. Bryales. Orthotrichaceae. N. Amer. Fl. 15A(1): 62.

Vitt, D. H. 1994. *Macromitrium. In:* A. J. Sharp, H. Crum & P. M. Eckel (editors), The Moss Flora of Mexico. Mem. New York. Bot. Gard. 69: 621–636.

Delimitation of the Genus *Nasturtium* (Brassicaceae)

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Robert A. Price
Department of Botany, University of Georgia, Athens, Georgia 30602, U.S.A.

ABSTRACT. *Nasturtium*, which is often reduced to synonymy of *Rorippa*, is recognized as a distinct genus of five species. It is more closely related to *Cardamine* than to *Rorippa*, and its distinguishing characters from these genera are given. The new combination *N. floridanum* is proposed, and a key to the species is provided.

The generic status and limits of *Nasturtium* R. Brown have been the subject of considerable controversy. In some of the recent accounts (e.g., Czerepanov, 1995; Hedge, 1968; Jonsell, 1993; Mabberley, 1997; Stuckey, 1972; Wannenmacher, 1986) the genus has been maintained, whereas in others (e.g., Al-Shehbaz, 1988; Al-Shehbaz & Rollins, 1988; Green, 1962; Jonsell, 1988; Rich, 1991; Rollins, 1993) it is reduced to synonymy of *Rorippa* Scopoli. Schulz (1936) also united the two genera, but he adopted *Nasturtium* for the combined genus, instead of the earlier-published *Rorippa*.

The basic disagreement among these treatments is whether or not the morphological differences between *Nasturtium* and *Rorippa* are sufficient to clearly distinguish the genera. There are numerous other examples of generic pairs in the Brassicaceae with similar controversial boundaries. Because of convergence in almost every conceivable character, emphasis on a small number of morphological characters can often result in artificial generic groupings within the family. The use of molecular data, along with critical evaluation of morphology, can often help resolve conflicts between competing hypotheses about the limits and relationships of genera of the Brassicaceae (Al-Shehbaz & Warwick, 1997; O'Kane & Al-Shehbaz, 1997). A case in point is the delimitation of *Nasturtium* and *Rorippa*.

Sequence comparisons of chloroplast DNA consistently support the separation of *Nasturtium* as a genus very distinct from *Rorippa*, and indicate that *Nasturtium* is most closely related to the cosmopolitan genus *Cardamine* L. This result was obtained by Les (1994), who compared sequences of the gene *rbc*L for six species in the cardaminoid group of Brassicaceae and found relatively strong support for a grouping of *N. officinale* R. Brown with *C. pensylvanica* Muhlenberg ex Willdenow, while two species of *Rorippa*, *R. sylvestris* (L.) Besser (the generic type) and *R. amphibia* (L.) Besser, formed a separate clade more closely related to lakecress (*Neobeckia aquatica* (Eaton) E. L. Greene) and horseradish (*Armoracia rusticana* P. Gaertner). Recent comparisons of the more rapidly changing chloroplast gene *ndh*F and the *trn*L-F intron and spacer regions (Price & Sweeney, in prep.) indicate that the endangered species *N. gambellii* (S. Watson) O. E. Schulz forms a well supported clade with *N. officinale* and that the genus *Nasturtium* is much more closely related to *Cardamine* than to other genera in the cardaminoid group, including *Armoracia* Gaertner et al., *Rorippa*, and *Barbarea* R. Brown.

As presently delimited, *Nasturtium* is readily distinguished from *Rorippa* by a combination of characters, including a perennial, almost always aquatic habit, hollow stems rooting at the submersed and lower nodes, pinnate emergent leaves with 1–9(–15) pairs of lateral leaflets that are never decurrent on the rachis, white flowers, curved, cylindric fruits, and reticulate seed coats, and by the absence of median nectar glands. Species of *Rorippa* are annuals or perennials of wet or mesic areas and almost always have taproots and only very rarely (e.g., *R. amphibia* and *R. fluvitalis* (E. Meyer ex Sonder) Thellung, both of which are yellow-flowered aquatics with simple leaves) root at the lowermost nodes. They have solid or rarely hollow stems, yellow or occasionally white flowers, nearly always median nectar glands, and colliculate, minutely rugose, papillose, verrucose, or reticulate seeds. The leaves of *Rorippa* range from entire to toothed, sinuate, or pinnatisect, and rarely form leafletlike lobes. When leafletlike lobes are present, they are always decurrent on the rachis, and the uppermost leaves are often simple. *Nasturtium* plants growing in water almost always produce simple leaves on submersed stems, but emergent

shoots always produce compound leaves (Michaelis, 1976; Rollins, 1978). The fruits of *Rorippa* range from globose to ovoid, oblong, clavate, or cylindric.

Cardamine is readily distinguished from *Nasturtium* by its unique fruits that dehisce explosively, by its spirally coiled valves that lack a distinct midvein, and by its flattened replum. In *Nasturtium* the fruits do not dehisce explosively, the valves have a distinct midvein and do not coil after dehiscence, and the replum is rounded.

Nasturtium as circumscribed here includes five species: *N. officinale* (the type species, which is the watercress of commerce) and *N. microphyllum* Boenninghausen ex Reichenbach (both of which are native to Eurasia and northern Africa and widely naturalized elsewhere), the Moroccan *N. africanum* Braun-Blanquet, and the North American *N. gambellii* (California, Mexico), and *N. floridanum* (Al-Shehbaz & Rollins) Al-Shehbaz & Price (Florida). A new combination for the last is herein proposed.

Nasturtium valdes-bermejoi Castroviejo, which was described from Spain (Castroviejo, 1986), appears to be a minor variant of *N. microphyllum*. It was not recognized in the revised account of the genus for *Flora Europaea* (Valentine, 1993), and its alleged differences from *N. microphyllum* clearly fall within the variation range of that species.

Further study is needed of several morphologically anomalous species that appear to fit better into *Rorippa* than into *Nasturtium*. The recently discovered New Caledonian *Rorippa neocaledonica* Jonsell (Jonsell, 1995, 1997) is an annual with decurrent leafletlike lobes, yellow flowers, and verruculose seeds, and it does not produce adventitious roots at the lower nodes. We have not seen the type or other material of the species, and we believe that the species is a good member of *Rorippa*. It appears to be related to *R. sarmentosa* (DC.) J. F. Macbride of the Pacific Islands (Jonsell, 1997; Smith, 1981; Wagner et al., 1990). Though *R. sarmentosa* has compound leaves and is sometimes perennial with adventitious roots at the lower nodes, it clearly differs from *Nasturtium* in being a mesic rather than aquatic plant, and in having solid stems, median nectaries, yellow flowers, and papillose seeds (Jonsell, 1997). The Madagascar endemic *R. laurentii* Jonsell (Jonsell, 1979) has white flowers and pinnatisect leaves, but its erect stems that do not root at the lower nodes, broadly flattened fruits, median nectar glands, and ridged seeds clearly exclude it from *Nasturtium*.

Key to the Species of *Nasturtium*

1a. Seeds biseriate in each locule, coarsely reticulate, with 25–50(–60) areolae on each side; mature fruit (1.8–)2–3 mm wide . . . . . *N. officinale*
1b. Seeds uniseriate in each locule, moderately to minutely reticulate, with more than 100 areolae on each side; mature fruit 0.8–1.2(–1.8) mm wide.
  2a. Emergent leaves not auriculate at base, 3- or very rarely 5-foliolate; seeds yellowish brown; style obsolete; plants endemic to Florida . . . . . *N. floridanum*
  2b. Emergent leaves often minutely auriculate at the petiole base, (3 or)5–15-foliolate; seeds reddish brown; style distinct; plants of other parts of the world.
    3a. Fruit abruptly ending in a style to 1 mm; leaflets entire to repand; seeds with 100–150(–175) areolae on each side . . . . . *N. microphyllum*
    3b. Fruit attenuate into a slender style 1.5–2.5 mm; leaflets often coarsely dentate, rarely subsinuate-repand; seeds with 300–450 areolae on each side.
      4a. Fruits 0.8–1(–1.5) mm wide; seeds not mucilaginous when wetted; plants of California and Mexico . . . . . *N. gambellii*
      4b. Fruits 1.5–1.8 mm wide; seeds mucilaginous when wetted; plants of Morocco . . . . . *N. africanum*

Nasturtium floridanum (Al-Shehbaz & Rollins) Al-Shehbaz & Price, comb. nov. Basionym: *Rorippa floridana* Al-Shehbaz & Rollins, J. Arnold Arbor. 69: 68. 1988. *Cardamine curvisiliqua* Shuttleworth ex Chapman, Fl. South. U.S. 605. 1887; not *Rorippa curvisiliqua* (W. J. Hooker) Bessey ex Britton, Mem. Torrey Bot. Club 5: 169. 1894; not *Nasturtium curvisiliquum* (W. J. Hooker) Nuttall ex Torrey & A. Gray, Fl. N. Amer. 1: 73. 1838. *Nasturtium stylosum* Shuttleworth ex O. E. Schulz, in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 17B: 553. 1936; not *N. stylosum* (DC.) O. E. Schulz ex Cheesman, Trans. & Proc. New Zealand Inst. 43: 179. 1911; not *Rorippa stylosa* (DC.) Allan, Fl. New Zealand 1: 188. 1961; not *R. stylosa* (Persoon) Mansfield & Rothmaler, Repert. Spec. Nov. Regni Veg. 49: 276. 1940. TYPE: U.S.A. Florida: "in uliginosis subsalsis ad fluv. St. Marks, prope St. Marks, April–May 1843," *Rugel s.n.* (lectotype, designated by Al-Shehbaz & Rollins (1988); isolectotype, GH).

Rorippa floridana was proposed by Al-Shehbaz and Rollins (1988) as a new name for the Florida endemic *Cardamine curvisiliqua* Shuttleworth ex Chapman, because the transfer of the latter name to *Rorippa* would have created a later homonym of *R. curvisiliqua* (W. J. Hooker) Bessey ex Britton, a

species restricted to the western United States (Alaska south into Wyoming and Montana to California). The transfer of the epithet *curvisiliqua* Shuttleworth ex Chapman to *Nasturtium* would also create a later homonym of *N. curvisiliqua* (W. J. Hooker) Nuttall ex Torrey & A. Gray. This species was also known as *N. stylosum* Shuttleworth ex O. E. Schulz, but this name is also a later homonym of the New Zealand endemic *N. stylosum* (DC.) O. E. Schulz ex Cheesman.

Literature Cited

Al-Shehbaz, I. A. 1988. The genera of Arabideae (Cruciferae; Brassicaceae) in the southeastern United States. J. Arnold Arbor. 69: 85–166.

——— & R. C. Rollins. 1988. A reconsideration of *Cardamine curvisiliqua* and *C. gambellii* as species of *Rorippa* (Cruciferae). J. Arnold Arbor. 69: 65–71.

——— & S. I. Warwick. 1997. The generic disposition of *Quidproquo confusum* and *Sinapis aucheri* (Brassicaceae). Novon 7: 219–220.

Castroviejo, S. 1986. *Nasturtium valdes-bermejoi*, sp. nov., de la Provincia de Huelva. Anales Jard. Bot. Madrid 43: 15–19.

Czerepanov, S. K. 1995. Vascular Plants of Russia and Adjacent States (the Former USSR). Cambridge Univ. Press, Cambridge.

Green, P. S. 1962. Watercress in the New World. Rhodora 64: 32–43.

Hedge, I. 1968. Arabideae. *In:* K. H. Rechinger (editor), Fl. Iranica 57: 193–218. Akademische Druck-u. Verlagsanstalt, Graz.

Jonsell, B. 1979. New taxa of Cruciferae from East Tropical Africa and Madagascar. Bot. Not. 132: 521–535.

———. 1988. Cruciferae. *In:* C. G. G. J. van Steenis (editor), Fl. Malesiana, ser. 1, 10: 541–560. Kluwer Academic Publishers, Dordrecht.

———. 1993. *Rorippa*. *In:* T. G. Tutin et al. (editors), Flora Europaea, ed. 2, 1: 344–345. Cambridge Univ. Press, Cambridge.

———. 1995. Une espèce nouvelle de *Rorippa* (Cruciferae) de Nouvelle-Calédonie. Bull. Mus. Natl. Hist. Nat., Paris, ser. 4, 17: 175–177.

———. 1997. Cruciferae (Brassicaceae). *In:* P. Morat (editor), Fl. Nouvelle-Calédonie 21: 81–117. Muséum national d'Histoire Naturelle, Paris.

Les, D. H. 1994. Molecular systematics and taxonomy of lake cress (*Neobeckia aquatica;* Brassicaceae), an imperiled aquatic mustard. Aquatic Bot. 49: 149–165.

Mabberley, D. J. 1997. The Plant-book, ed. 2. Cambridge Univ. Press, Cambridge.

Michaelis, F. B. 1976. Watercress (*Nasturtium microphyllum* (Boenn.) Rchb. and *N. officinale*) in New Zealand. Aquatic Bot. 2: 317–325.

O'Kane, S. L., Jr. & I. A. Al-Shehbaz. 1997. A synopsis of *Arabidopsis* (Brassicaceae). Novon 7: 323–327.

Rich, T. C. G. 1991. Crucifers of Great Britain and Ireland. Bot. Soc. British Isles Handbook 6: 1–336.

Rollins, R. C. 1978. Watercress in Florida. Rhodora 80: 147–153.

———. 1993. The Cruciferae of Continental North America. Stanford Univ. Press, Stanford.

Schulz, O. E. 1936. Cruciferae. *In:* A. Engler & K. Prantl (editors), Nat. Pflanzenfam., ed. 2, 17B: 227–658. Verlag von Wilhelm Engelmann, Leipzig.

Smith, A. C. 1981. Brassicaceae. Flora Vitiensis Nova 2: 703–711. Lawai, Hawaii.

Stuckey, R. L. 1972. Taxonomy and distribution of the genus *Rorippa* (Cruciferae) in North America. Sida 4: 279–430.

Valentine, D. H. 1993. *Nasturtium*. Pp. 345–346 *in* T. G. Tutin et al. (editors), Flora Europaea, ed. 2. Cambridge Univ. Press, Cambridge.

Wagner, W. L., D. R. Herbst & S. H. Sohmer. 1990. Brassicaceae. Pp. 398–414 *in* Manual of the Flowering Plants of Hawai'i, vol. 1. Univ. Hawaii Press & Bishop Museum Press, Honolulu.

Wannenmacher, R. 1986. Cruciferae. *In:* G. Hegi (editor), Illustrierte Fl. Mittel-europa 4(1): 73–514. Verlag Paul Parey, Berlin.

Two New Subspecies of *Quararibea yunckeri* (Bombacaceae) from Edo. Veracruz, Mexico

William S. Alverson
Harvard University Herbaria, 22 Divinity Avenue, Cambridge, Massachusetts 02138, U.S.A.
email: walverso@oeb.harvard.edu

ABSTRACT. Descriptions are given of two new taxa, *Quararibea yunckeri* subsp. *sessiliflora*, and *Q. yunckeri* subsp. *veracruzana*, with summaries of their distributions.

To facilitate the publication of a treatment of Bombacaceae for the *Flora of Veracruz* (Avedaño Reyes, in prep.), brief descriptions are presented of two new subspecies within the genus *Quararibea* Aublet (Bombacaceae). The genus (exclusive of the closely related *Matisia* Humboldt & Bonpland) comprises approximately 30 species of wet and moist forest trees that occur from southern Mexico and the Antilles to southeastern Brazil, northern Bolivia, and Peru (Alverson, 1986). A forthcoming synopsis of Mesoamerican *Quararibea* will provide keys and additional information for the subspecies discussed here (Alverson, in prep.).

Quararibea yunckeri Standley, in Yuncker, Field Mus. Nat. Hist. (Bot.) 9(4): 306–307. 1940. TYPE: Honduras. Depto. Atlántida: river bank, foothills back of La Ceiba, 25 June 1938, *Yuncker, Koepper & Wagner 8010* (holotype, F; isotypes, BM, F, GH, LL, MO, S).

Quararibea yunckeri Standley subsp. **sessiliflora** Miranda ex W. S. Alverson, subsp. nov. TYPE: Mexico. Edo. Veracruz: Estación Biológica Los Tuxtlas, San Andrés Tuxtla, 120 m alt., 9 Dec. 1969, *Martinez C. 2122* (holotype, MEXU; isotypes, ENCB, F, GH, MO, UC).

Subspecies haec a *Quararibea yunckeri* Standley subsp. *yunckeri* differt foliis acarodomatiis nullis.

Tree, (3–)6–15(–20) m tall. Petioles 5–22 mm long. Leaf blades elliptic, 6–18 cm long, 2–7 cm wide, the apex acute to acuminate, the base cuneate to rounded or truncate, nonbarbate beneath. Flowers solitary and opposite the leaves, or more commonly clustered on short, often leafless, axillary shoots, or on other leafless portions of the young branches, the flowering pedicels 2–4 mm long, bearing 3 triangular bracteoles. Calyx 6–10 mm long, ca. 4 mm diam. at mouth, without longitudinal wings or ridges. Corolla actinomorphic, the petals spatulate to narrowly spatulate, reflexed at anthesis, 11–16 mm long and 2–3 mm wide when dry, white when fresh. Staminal column cylindric, 11–17 mm long (including the 5 short teeth at summit), 2–4 mm diam. across middle of lobes when dried. Style filiform, 12–21 mm long, ca. 1 mm diam. near apex, exceeding the staminal lobes by 1–2 mm. Fruits ellipsoid, 13–23 mm long and 10–16 mm diam. when mature and dried, bluntly mammilate for 2–3 mm.

Paratypes. MEXICO. **Veracruz:** Lado SE de Lago Catemaco, arriba de Río Cuetzalpan, 600 m alt., 25 Oct. 1971, *Beaman 5167* (F, GH, MEXU, US); Poblado de Laguna Escondida a 5 km de la estación de biología tropical Los Tuxtlas, San Andrés Tuxtla, 18°35′N, 95°05′W, 300 m alt., 24 Aug. 1974, *Calzada 1456* (ENCB, F, MEXU), 18 Oct. 1974, *Calzada 1580* (ENCB, MEXU, NY).

Quararibea yunckeri Standley subsp**. veracruzana** W. S. Alverson, subsp. nov. TYPE: Mexico. Edo. Veracruz: Sta. Ana Atzacan al N de Orizaba, 51-B-2 [sic], a orillas de la población, 1360 m alt., 18 Feb. 1967, *Rosas R. 190* (holotype, MEXU; isotypes, A, ENCB, LL, MO, UPS).

Subspecies haec a *Quararibea yunckeri* Standley subsp. *yunckeri* differt pedicellis floriferis longioribus (8–14 mm longis vs. 2–6 mm longis).

Small tree, 6–12 m tall. Petioles 5–12 mm long. Leaf blades elliptic, usually slightly asymmetric, 6–16 cm long, 2–6 cm wide, the apex acute to acuminate to short-caudate, the base cuneate to rounded to truncate and often slightly oblique, very conspicuously barbate beneath. Flowers unknown. Fruiting pedicels (8–)11–14 mm long, bearing 2–3 persistent bracteoles on the basal ⅓. Calyx shallowly cupulate, its margins tearing and broadly spreading away from the base of the fruit when dried, 7–11 mm long, longitudinally subrugose. Fruits ellipsoid to broadly ovate, 15–18 mm long and 13–19 mm diam. when dried, 1- or 2-seeded, frequently asymmetric, the apex bluntly mammilate.

Paratypes. MEXICO. **Veracruz:** Municipio de Jilotepec, Vista Hermosa, ladera de cerro, 1350 m alt., 14 Dec. 1970, *Ventura A. 2998* (ENCB, F, MICH); Municipio de Córdoba, San Rafael, 800 m alt., 10 Jan. 1980, *Ventura A. 16716* (ENCB).

Quararibea yunckeri subsp. *sessiliflora* grows in low- to mid-elevation forests of eastern Edo. Veracruz and western Edo. Chiapas, Mexico, and subspecies *veracruzana* is endemic to forests at altitudes of 800–1360 m in central Edo. Veracruz. The typical subspecies, *Quararibea yunckeri* subsp. *yunckeri*, occurs in low- to mid-elevation forests (300–1000 m alt.) of the Caribbean drainage system in northern Honduras, southern Belize, central Guatemala, and easternmost Mexico (Edo. Chiapas). It differs most conspicuously from subspecies *sessiliflora* by the presence of domatia on the undersurface of leaves, and from subspecies *veracruzana* by its shorter flowering and fruiting pedicels.

Literature Cited

Alverson, W. S. 1986. *Quararibea* Aubl. s.l. (Bombacaceae) in Mexico, Central America and the Antilles: A Taxonomic Study. Ph.D. Dissertation, University of Wisconsin, Madison, Wisconsin.

A New Species of *Jacquinia* (Theophrastaceae) from Veracruz, Mexico

Gonzalo Castillo-Campos and Ma. Elena Medina Abreo

Instituto de Ecología, A.C., km 2.5 Carretera Antigua a Coatepec, Apartado Postal 63, 91000 Xalapa, Veracruz, Mexico; email castillo@sun.ieco.conacyt.mx

ABSTRACT. *Jacquinia morenoana*, a new species of Theophrastaceae from the northern coast of the state of Veracruz, Mexico, is described. A discussion of its affinities with *J. macrocarpa* Cavanilles subsp. *macrocarpa*, based on the habitat and morphological characters, is presented.

RESUMEN. Se describe como especie nueva a *Jacquinia morenoana* (Theophrastaceae) de la costa norte del estado de Veracruz, México. Se discuten sus afinidades con *J. macrocarpa* subsp. *macrocarpa*, se indica el hábitat y se discuten las características morfológicas que las distinguen.

While reviewing material of Theophrastaceae from Veracruz, Mexico, in several herbaria (CHAPA, ENCB, MEXU, NY, US, and XAL), a specimen with glandular hairs on the flowers was detected; this character had not been previously reported for the genus *Jacquinia*. The material is described and illustrated below as a new species.

Jacquinia morenoana Castillo-C. & Medina, sp. nov. TYPE: Mexico. Veracruz: Barra de Cazones, on the pasture near the beach, Municipio of Cazones, elevation 10 m, 20 June 1986, *S. Vargas 91* (holotype, XAL). Figure 1.

Frutex perennis, 3 m altus. Ramorum terminalium nodi bracteae cumulatis, primordia meristematica ramorum recentium tegentibus, 1–4 mm longis, triangularibus, pubescentibus. Folia maximam partem ad nodos cumulata, lanceolata usque ad oblanceolata, 2.0–7.5 cm longa, 0.6–2.2 cm lata ad medium, apice acuta, subinde suborbicularia, in spinam rigidam terminantia. Inflorescentia terminalis, racemosa, 6–9 flora, pedicello 0.7–1.6 cm longo, ad basim bracteole triangularem vel squamiformem ferenti. Flores hermaphroditi, bilobulati, campanulati, aurantiaco-rubri, carnosi, 7 mm longi, pubescentes, pilos glandulosos ferentes, glandulis nigris. Fructus globosus usque ad leviter conicus, saepe truncatus, apice acuto, rigido, valido, cicatricem circularem ad pistilli basem ferens, ad apicem niger, 2.3–3.7 cm longus, 1.5–2.3 cm latus, viridis, aurantiacus, nitens, in sicco corrugatus.

Perennial shrub, 3 m tall; terminal branches pubescent with simple hairs, with dark brown longitudinal lines that give a corrugated aspect, bracteolate, the bracts 2.5 mm long, lanceolate, pubescent, ciliate. Leaf-buds perulate, bracts 1–4 mm long and 0.7–1.0 mm broad at base, lanceolate, ciliate, triangular, with two transverse lines, pubescent. Leaves 2.0–7.5 cm long, 0.6–2.2 cm broad in the middle, spaced and clustered along the branches, rigid, coriaceous, lanceolate to obovate-lanceolate, apex acute, occasionally ending with an obtuse, rigid spine, 2.0–3.5 mm long, brownish green, base decurrent and thick, margin revolute and thick; abaxial surface glabrous, punctate, lineolate when dry, giving a corrugated aspect, costa prominent; upper surface mainly glabrous, gray when dry, shiny, evidently penninerved, punctate, costa pubescent at base; petiole 1–2 mm long. Inflorescences terminal racemes, 6–9-flowered; peduncle 2.5–5.0 cm long, corrugated, pilose, lignified, with bracts at the base; pedicel 0.7–1.6 cm long, broadened toward the apex, corrugated, with a triangular bracteole near the base, pilose, ciliate, apically acute with a black line on the base. Flowers hermaphroditic, orange-red, 7 mm long; calyx cupular, corrugated, glabrous, sepals 5, 3.0 × 3.3 mm, suborbicular, imbricate, the margin thin, membranous, glabrous, entire; corolla campanulate, 5-lobed, the tube 5 mm long, lobes 4 × 4 mm, corrugated, with glandular hairs internally, outer surface covered with hairs tipped with a dark to black gland, inner corolla appendices 5, 1.5–2.0 × 2.5 mm, alternate to corolla lobes, on top of corolla tube; stamens 5, foliaceous, adnate to the middle of corolla tube, filament 5 × 0.8 mm, anthers extrorse, dithecal, 2.5 × 1.5 mm; style 2 mm long, stigma capitate, with 5 terminal divisions, ovary 1.5 mm broad. Fruit 2.3–2.7 cm long, 1.5–2.3 cm broad, globose to slightly conical, frequently flattened, apex acute, rigid, hard, with a circular callus at the base of the remains of the style, green, yellow, or orange, tip black, shiny, corrugated; seeds 8 mm long, 6.5 mm broad, immersed in a brown mucilaginous endocarp, flat, shiny, corrugated, brown.

Habitat. *Jacquinia morenoana* is found in remnants of semi-evergreen seasonal forest. It is abundant locally, at elevations of 10–290 m; associated species include *Acacia cornigera* (L.) Willdenow,

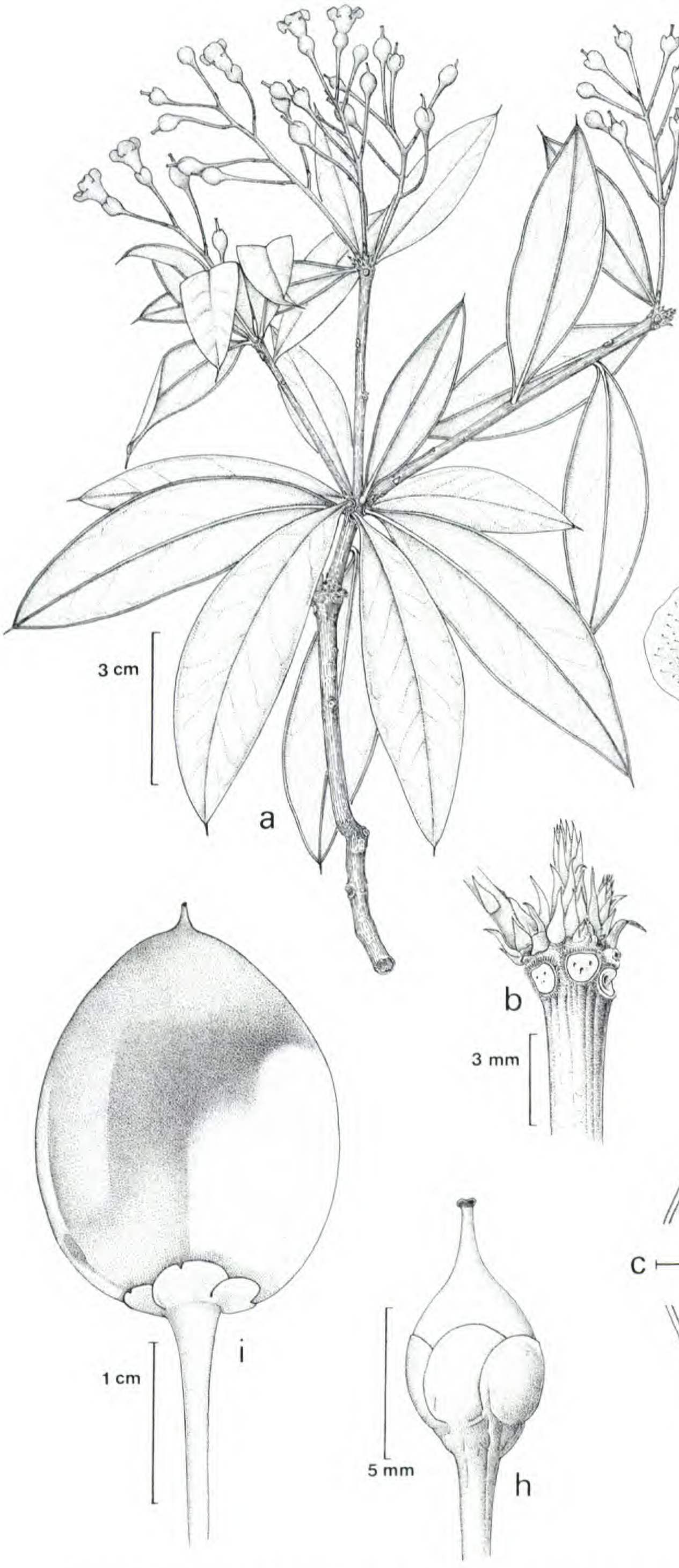


Figure 1. *Jacquinia morenoana* Castillo-C. & Medina.—a. Branch with inflorescence. —b. Bracts grouped on the apex of the youngest branches. —c. Detail of the base and the apex of the leaves. —d. Flower with glandular hairs. —e. Detail of an open flower. —f. Glandular hair. —g. Anther. —h. Small fruit. —i. Mature fruit. —j. Detail of dry seed. Illustrated by Edmundo Saavedra based on the herbarium specimens of *Vargas 91* and *Castillo & Medina 16032, 16033, 16034.*

Table 1. Similarities and differences between *Jacquinia morenoana* and *J. macrocarpa* subsp. *macrocarpa*.

		Jacquinia morenoana	*Jacquinia macrocarpa* subsp. *macrocarpa*
Leaf	Shape	lanceolate, obovate-lanceolate	oblanceolate, obovate-oblong, obovate
	Length	2.0–7.5 cm	3.5–8.0 cm
	Width	0.6–2.2 cm	1.1 cm
	Apex	acute, ending on a rigid spine, brownish green, 2.0–3.5 mm long	acute or obtuse with one spine green-yellowish-brown, 1–2 mm long
	Base	decurrent	decurrent
Petiole	Length	1–2 mm	1.5 mm
Flowers	Number	6–9	5
	Length	7 mm	8–10 mm
	Color	orange-red	orange-red shiny
	Pubescence	glandular hairs	glabrous
Pedicel	Length	7–16 mm	6–18 mm
Fruit	Shape	globose	globose
	Length	2.3–2.7 cm	0.8–2.8 cm
	Width	1.5–2.3 cm	1.5–2.0 cm

Acacia farnesiana (L.) Willdenow, *Coccoloba barbadensis* Jacquin, *Desmanthus virgatus* (L.) Willdenow, *Eugenia capuli* (Chamisso & Schlechtendal) O. Berg, *Hyptis verticillata* Jacquin, *Operculina pinnatifida* (Kunth) O'Donell, *Parmentiera aculeata* (Kunth) Seemann, *Pithecellobium lanceolatum* (Humboldt & Bonpland ex Willdenow) Bentham, *Psidium guajava* L., *Sabal mexicana* Martel, *Schleelea liebmannii* Beech, *Solanum diphyllum* L., and *Tabernaemontana alba* Miller.

Phenology. Flowering from June to July; fruiting from August to September.

Local name. Arbol de Navidad.

Uses. Ornamental. Not cultivated, but appreciated because of the shape of its top, which resembles a little pine tree. *Jacquinia morenoana* is a native species that grows abundantly in natural populations around the town of Cazones. People there preserve the specimens that grow naturally in their gardens or backyards and decorate them during Christmas.

The specific epithet alludes to the outstanding researcher Patricia Moreno Casasola of the Instituto de Ecología, A.C., Xalapa, Veracruz, who has dedicated most of her life to the study of the ecology of dunes on the Gulf and the Pacific coasts of Mexico.

Paratypes. MEXICO. **Veracruz:** Barra de Cazones north beach, S of the town of Cazones, Municipio of Cazones, *Castillo & Medina 16032, 16033, 16034* (ENCB, IEB, MEXU, XAL).

Discussion

Because of the color of its flowers, *Jacquinia* appears to comprise two groups, both of which need more research. One group of species, those from Central America, some from South America, and those of the Antilles, have white flowers. The other group, where *Jacquinia morenoana* belongs, has orange flowers; this group is difficult to separate into clear-cut species because of considerable foliar variation between populations and individuals. In the field some populations appear to be made up of individual plants from different species, but when the material is studied in the herbarium it appears to belong to only one species.

While working on a revision of the Theophrastaceae for the state of Veracruz we found in *Jacquinia* large morphological variability in the leaves of the individuals and specimens in the populations distributed throughout the state. This variability was observed by Mez (1903) and Votsch (1904). Likewise, Ståhl (1989), recognizing this variability in *J. macrocarpa* Cavanilles, reorganized the species concept, leaving only two subspecies (subsp. *macrocarpa* and subsp. *pungens* (A. Gray) Ståhl) as inhabitants of the coastal areas in Mexico. Of these *J. macrocarpa* subsp. *macrocarpa* is found along both the Gulf and Pacific coasts. In Veracruz the subspecies was previously recorded before under either of two synonyms: *J. aurantiaca* Aiton and *J. schiedeana* Mez. So far, *J. morenoana* has been found only in northern Veracruz.

Jacquinia morenoana seems to be closely related to *J. macrocarpa* subsp. *macrocarpa.* It differs mainly in the presence of glandular hairs on the corolla; *J. macrocarpa* subsp. *macrocarpa* has glabrous flowers. Other small differences in the length of the leaves and the petioles, the number of flowers per inflorescence, the size of the flowers, and the

length of the apical spine of the leaves (Table 1) distinguish the new species. No species with glandular hairs on the corolla or even with pubescent flowers was known before in the genus *Jacquinia*.

Acknowledgments. Our most sincere acknowledgments to Jerzy Rzedowski Rotter for the Latin translation and comments on the manuscript; to Francisco Lorea and Andres Vovides for comments on the manuscript; to Lilly Gama for the English translation; and to Edmundo Saavedra for the illustration.

Literature Cited

D'Arcy, W. G. 1980. Theophrastaceae. *In:* Flora of Panama. Ann. Missouri Bot. Gard. 67: 1047–1055.

Mez, C. 1903. Theophrastaceae. *In:* Engler, Pflanzenr. 15 (IV. 236 a) 48.

Ståhl, B. 1989. A synopsis of Central American Theophrastaceae. Nordic J. Bot. 9: 15–30.

Votsch, W. 1904. Neue systematische-anatomische Untersuchungen von Blatt und Achse der Theophrastaceen. Bot. Jahrb. Syst. 33: 502–546.

Lycianthes jalicensis (Solanaceae), a New Species from Jalisco, Mexico

Ellen Dean

UC Davis Herbarium, Section of Plant Biology, # 1 Shields Ave.,
University of California at Davis, Davis, California 95616, U.S.A.

ABSTRACT. A new species of *Lycianthes* from Jalisco, Mexico, is described and illustrated as *L. jalicensis* E. Dean.

Comprising 150–200 species (D'Arcy, 1997), *Lycianthes* (Solanaceae) has both Old World and New World representatives; however, its center of distribution, and the majority of its taxa, are found in the New World (from Mexico to Argentina). The genus is generally thought to be a close relative of *Capsicum* (Olmstead & Palmer, 1992; Bitter, 1919) but differs from that genus in having poricidally dehiscent anthers. While in Mexico in 1991, I collected specimens of a new species of *Lycianthes* in the state of Jalisco, Mexico. After examining other specimens of the species from several different herbaria, I am able to describe it here.

The terminology used to describe the branching pattern of the species follows that of Child and Lester (1991). The erect portions of the plants of this species arise from a horizontal rhizome. The erect plant body has a basal segment with spirally arranged leaves, which is considered the first sympodial unit of the plant; that segment terminates in a bud or a flower. Thereafter, all branches are short sympodial units consisting of two leaves and a flower. The upper branching can be dichasial or monochasial; if it is unichasial, the leaf arrangement is geminate.

As described for other *Lycianthes* spp. (Dean, 1994), the flowers of *L. jalicensis*, which are usually angled upward from the stem, open and close each morning for several days in a row (usually 3 days). The corolla is sympetalous, with the limb divided into five lobes, which are connected by membranous tissue. The shape of the corolla can be described as campanulate, but the pressure of opening can tear the corolla membrane by the last day of anthesis, allowing the corolla to open more fully. The five stamens of the androecium are unequal, with the lowest stamen longest, and of about the same length as the style, while the other four stamens are substantially shorter. The uppermost two anthers, or both the uppermost and lateral anthers, usually dehisce on the first day of anthesis, with the lowermost anther dehiscing on the third day the flower opens.

Bees that visit the flowers of *Lycianthes jalicensis* buzz the anthers to extract the pollen, as has been described for various *Solanum* species (Buchmann et al., 1977). The population that I visited near El Tuito, Jalisco, had open flowers during our first visit, which was from 7:00 AM (sunrise) to 8:16 AM, and bees were already buzzing the flower anthers. When the same population was visited at 11:00 AM, the flowers were closed. The insects that we observed and collected belonged to the genus *Ptiloglossa* (Colletidae).

Lycianthes jalicensis E. Dean, sp. nov. TYPE: Mexico. Jalisco: S of Puerto Vallarta and N of El Tuito, along hwy. 200, 20.3 road km S of Playa Mismaloya, W side of the road, along footpath that follows small drainage, 500 m, 13 Aug. 1991, *E. Dean & T. Starbuck 248* (holotype, DAV; isotypes, MEXU, UC, XAL). Figure 1.

Frutices e rhizomatibus orientes. Trichomata simplicia. Inflorescentiae flores 1–7. Corolla alba, campanulata; filamentis staminum inaequalibus, 4 brevibus, 1 longiore. Fructus ruber, rotundus.

Clonal *shrubs* from horizontal rhizomes, to 2 m tall. *Indument* of white, simple, acute, several-celled trichomes. Aboveground *stems* green to purple with vertical purple striations, the nodes often a darker purple; first (vertical) stem segment often elongate, comprising up to ¾ of total plant height, but sometimes short and branched from near ground-level; sympodial growth extensive, the oldest segments 4.5–8.5 cm long, 1–3 mm wide. *Stem pubescence* often sparse, antrorse to spreading, 0.25–1 mm long, the stem usually glabrate with age. *Sympodial leaves* membranaceous with arcuate venation, the sympodial units difoliate, usually geminate, sometimes appearing unifoliate if subtending dichasial forks, the total leaf length 5–17 cm long, 1.5–7.5 cm wide, the length of the larger leaf of a geminate pair 2–4 times longer than that

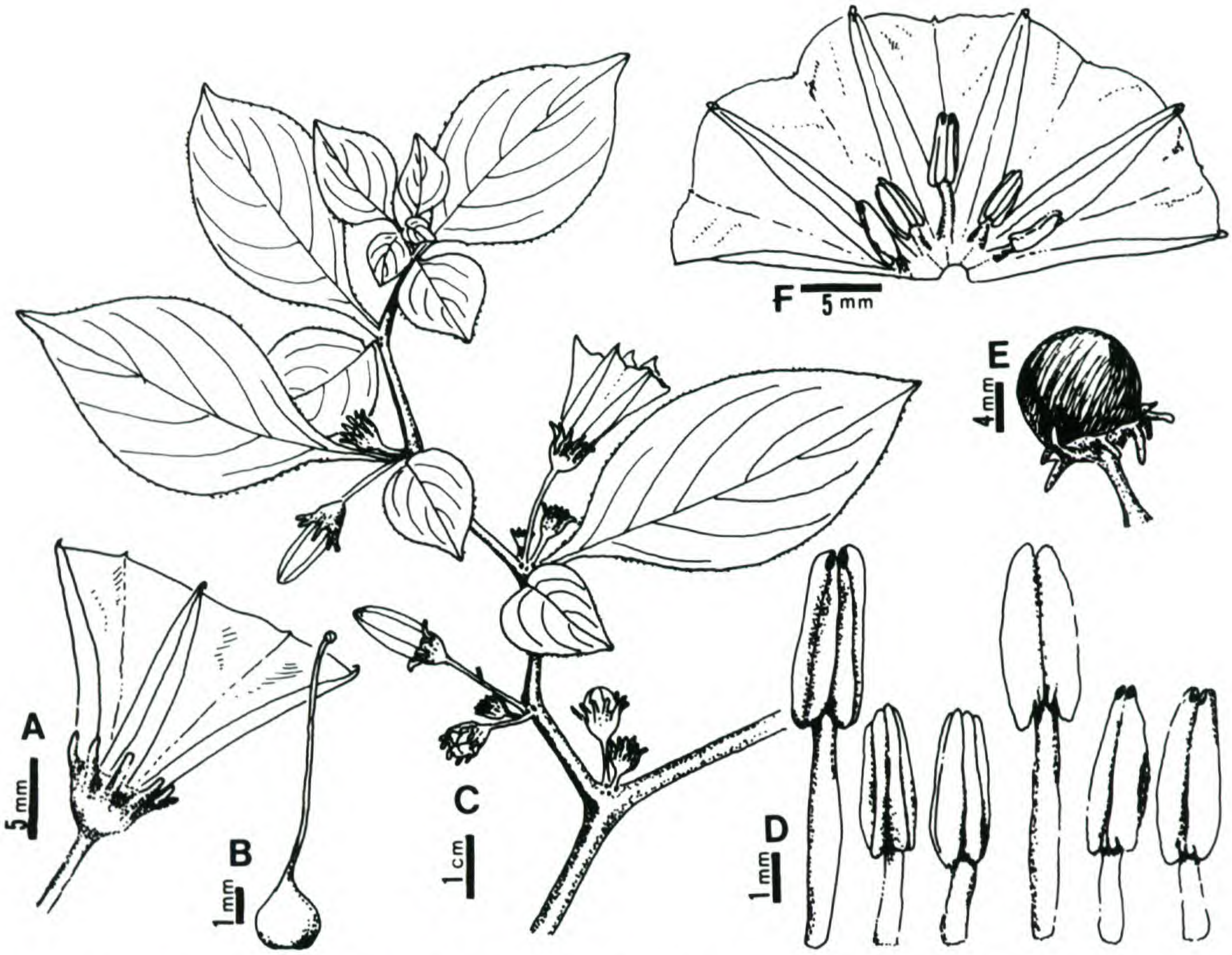


Figure 1. *Lycianthes jalicensis* E. Dean (from *E. Dean & T. Starbuck 331*). —A. Open flower as viewed from the side. —B. Gynoecium. —C. Flowering sympodia. —D. Androecium, showing views of (left to right) adaxial side of lowest stamen, adaxial side of one lateral stamen, adaxial side of one upper stamen, abaxial side of lowest stamen, abaxial side of one lateral stamen, and abaxial side of one upper stamen. —E. Fruit. —F. Dissection of corolla showing stamen insertion. (Drawn by the author.)

of the smaller leaf; the lamina of the larger leaf of the geminate pair ovate-elliptic to obovate, the tip acute to acuminate, the base of the more proximal leaves widely cuneate to attenuate (sometimes unequal), the petiole to 2 cm long, the base of the more distal leaves more cuneate and sessile; the lamina of the smaller of the geminate pair ovate, tip short-acuminate, base truncate, unequal, nearly sessile (petiole to 3 mm long). *Leaf pubescence* usually sparse, except on youngest leaves, 0.25–1 mm long, the trichomes of the adaxial side erect, spreading, the marginal ciliate, those of the abaxial side appressed ascending, concentrated along the veins. *Inflorescences* 1–7-flowered, terminating the stem units, the pedicels appearing to be in the axils of the geminate leaf pairs or the single leaves of dichasial forks, the flowers of a group maturing sequentially, only one flower open at a time in each inflorescence, that flower usually angled upward from the stem. *Pedicels at anthesis* green to purple, usually glabrous or nearly so, rarely puberulent with hairs 0.25 mm long, erect in bud, becoming curved as corolla emerges, straight to slightly curved when flower opens and 0.5–2.5 cm long. *Calyx at anthesis* pale green, with darker green ribs and teeth, usually glabrous or nearly so, cup-shaped, 2.5–4.0 mm long, 2.5–4.5 mm wide, the base and sides rounded, the margin membranous; calyx ribs ten, the ribs prominent in living material, extended into stout teeth-like projections with wide bases and acute tips, the teeth developing early in bud, first curved, quickly becoming erect and 1–5.5 mm long. *Corolla* sympetalous; basal portion inserted in calyx, campanulate, ca. 5 mm long; limb campanulate, with five valvate lobes connected nearly to their apices by the corolla membrane, each lobe lanceolate to oblanceolate, 0.6–2 cm long, 2–3.5 mm wide, white on adaxial side, green on abaxial side, opening and closing each morning; pubescence of corolla concentrated at lobe tips, the lobes themselves often glabrous or with very short hairs (0.1 mm long) abaxially. *Androecium* of five

stamens, the lowermost the longest, with filament 4–6 mm long and anther 4–6 mm long, the other four stamens much shorter, with filaments 0.5–1.5 mm long and anthers 4–5.5 mm long; filaments pale green, glabrous, compressed dorsiventrally, those of the short stamens curved outward; anthers light yellow, anther of the long stamen oblong with lateral pores that dehisce toward one another on the adaxial face, anthers of the short stamens lanceolate with nearly terminal pores on the abaxial face. *Gynoecium* of two united carpels; ovary widely ovoid 2–2.5 mm long, the ovules 60–100; style slightly curved downward, 6.5–11 mm long; stigma yellow-green, curved upward, oblong-capitate, ca. 0.5 mm long. *Fruit* a globose berry without sclerotic granules, green when immature, red when mature, 0.4–1.2 cm diam.; calyx in fruit expanded and often plate-like, 1.5–3.5 mm long, 3.5–8 mm diam., at length separating from the berry; calyx teeth in fruit curved upward, often broken, 1–3 mm long; pedicel in fruit 1–3.5 cm long; seeds depressed-ovate in outline, flat, 2.5–3 mm long, ca. 2 mm wide, tan to light brown, with thin margin ca. 0.25 mm wide. *Chromosome number*: $n = 12$ (information provided on *Iltis 29181*).

Distribution. In humid, seasonally dry, tropical subdeciduous forests, often near drainages, state of Jalisco, Mexico, 350–1100 m.

Lycianthes jalicensis flowers from July to December and produces fruits from August to December (possibly later). It can be distinguished from other *Lycianthes* by its combination of shrub habit, simple white trichomes (usually sparse), 1–7-flowered inflorescences, white campanulate corollas, unequal stamens, red round fruit, and tan to light brown flattened seeds. When fresh, the calyx has a distinctive rounded shape with very regular, equally inserted teeth that have stout, broad bases and acute tips. The collection *Iltis 29181* is included in the description of the species above; however, it differs from other specimens that I examined in its much denser pubescence.

The species has often been misidentified as *Lycianthes stephanocalyx* (Brandegee) Bitter, due to its sometimes few-flowered inflorescences and white, campanulate flowers. *Lycianthes stephanocalyx* differs in having an untoothed calyx, equal and fused stamens, and ovoid fruit. In addition, *L. stephanocalyx* is a rhizomatous perennial herb, whereas *L. jalicensis* is a woody plant. *Lycianthes jalicensis* has sometimes been identified as *L. surotatensis* Gentry. *Lycianthes surotatensis* differs in having glandular pubescence, a rotate corolla with green markings at the throat, and a more cuneate calyx base.

Paratypes. MEXICO. **Jalisco:** 24 km by road S of Autlán on road to Barra de Navidad, 760 m, 19 Sep. 1983, *W. Anderson 12717* (CAS, NY); Mpio. Casimiro Castillo, en la Calera, entre Puerto Los Mazos y el Tigre, 600–800 m, 24 Sep. 1988, *M. Cházaro B. et al. 5674* (CAS, WIS); 5.6 km por camino al W de Puerto Los Mazos, en el lado norte del "Cerro Autlán," 10 km distancia aérea al N de Casimiro Castillo, 19°41′30″N, 104°25′W, 1050 m, 6 Jan. 1985, *T. Cochrane et al. 10849b* (WIS); Mpio. Casimiro Castillo, Sierra de Manantlán, 6–8 km al N de C. Castillo, 19°39′15″N, 104°26′15″W, 800–1000 m, 5 Dec. 1987, *R. Cuevas & G. López 2902* (WIS); Casimiro Castillo, 19°36′43″N, 104°25′32″W, 400–500 m, 25 Sep. 1988, *R. Cuevas G. 3205* (WIS); S of Puerto Vallarta and N of El Tuito, along hwy. 200, 20.3 road km S of Playa Mismaloya, W side of the road, along footpath that follows small drainage, 500 m, 27 Nov. 1991, *E. Dean & T. Starbuck 331* (DAV, UC, XAL); "Arroyo de Tacubaya," at base of "Cerro La Petaca," 1–4 km E of Casimiro Castillo, ca. 20 km SSW of Autlán, 19°37′N, 104°26′W, 350–500 m, 19 Sep. 1978, *H. Iltis et al. 305* (WIS); S- and SE-facing midslopes and shoulders of "Cerro La Petaca," along trail to El Durazno, 5–10 km ESE of Casimiro Castillo, 19°33–35′N, 104°22–24′W, 900–1100 m, *H. Iltis et al. 348* (WIS); 1 km W of El Divisadero (1 km W of Villa Guerrero), 18 km ESE of Tomatlán, 19°53′N, 105°05′W, 350 m, 14 Jan. 1979, *H. Iltis & M. Nee 1637* (WIS); next to Mexico 80 on N-facing slope of Sierra de Autlán (but SW of Sierra de Manantlán, NW-end), ca. 1.5 km W of Puerto Los Mazos, 9 km (by air) SSW of Autlán, 19°42′N, 104°25′W, ca. 1350 m, 20 June 1984, *H. Iltis 29181* (CAS); Reserva Biosfera Sierra de Manantlán, La Calera, just NW of km 188 marker on Autlán–Manzanillo hwy. (Mex. 80), 9 km (by air) NNE of La Resolano (Casimiro Castillo) and ca. 16 km SSE of Autlán, 19°40′20–55″N, 104°24′00″–25′05″W, 800–1100 m, 10 Mar. 1992, *H. Iltis et al. 31037, 31058* (WIS); Quimixto, trail from San Pedro el Tuito, 60 m, 2 Dec. 1926, *Y. Mexia 1243* (UC); Santa Cruz de Vallarta, 700 m, 11 Dec. 1926, *Y. Mexia 1286* (CAS); Mpio. Casimiro Castillo, 15 km al SW de Autlán, Barranca del Tecolote, 19°37′20″N, 104°23′15″W, 800–900 m, 22 July 1987, *A. Vázquez 4521* (WIS).

Acknowledgments. I thank Tom Starbuck for his help with fieldwork; Victoria Sosa and the staff of XAL, who facilitated my work in Mexico in 1991; Howell Daly for identification of my insect specimens; Grady Webster and an anonymous reviewer for help with the Latin diagnosis; and the following institutions, which loaned me specimens: CAS, NY, UC, WIS. The fieldwork for this study was supported by an NSF predoctoral fellowship as well as grants from the following: the Department of Integrative Biology at UC Berkeley, Explorer's Club, Hardman Foundation, American Society of Plant Taxonomists, and Sigma Xi.

Literature Cited

Bitter, G. 1919. Die Gattung *Lycianthes*. Abh. Naturwiss. Vereine Bremen 24: 242–520.

Buchmann, S., C. Jones & L. Colin. 1977. Vibratile pollination of *Solanum douglasii* and *S. xanti* (Solanaceae) in southern California. Wasmann J. Biol. 35: 1–25.

Child, A. & R. N. Lester. 1991. Life form and branching within the Solanaceae. Pp. 151–159 *in* J. G. Hawkes et al. (editors), Solanaceae III, Taxonomy, Chemistry, and Evolution. The Royal Botanic Gardens, Kew.

D'Arcy, W. 1997. The genus *Lycianthes* (Solanaceae) in Venezuela. Ann. Missouri Bot. Gard. 84: 167–200.

Dean, E. 1994. *Lycianthes starbuckii* and *Lycianthes rzedowskii* (Solanaceae), two new species of perennial herbs from Mexico. Novon 4: 324–329.

Olmstead, R. & J. Palmer. 1992. A chloroplast DNA phylogeny of the Solanaceae: Subfamilial relationships and character evolution. Ann. Missouri Bot. Gard. 79: 346–360.

A New Species of *Marcgravia* (Marcgraviaceae) from the Venezuelan Guayana

Stefan Dressler

Forschungsinstitut Senckenberg, Senckenberganlage 25, D-60325 Frankfurt/M., Germany;
e-mail: sdressle@sngkw.uni-frankfurt.de

ABSTRACT. A new species, *Marcgravia punctifolia*, is described and illustrated. It occurs in the tepui region of the Guiana Shield and is distinguished from all other taxa of the genus by the combination of abaxially punctate leaves, leaf shape, and apparently cauliflorous inflorescences.

During preparation of the chapter on Marcgraviaceae for a forthcoming volume of the *Flora of the Venezuelan Guayana*, I discovered an as yet undescribed taxon of the genus *Marcgravia* L., which is validated below.

There are nine *Marcgravia* species known so far with abaxially dotted leaves. This feature is not common within the genus, and its function is up to now unclear, but it is a good diagnostic character. Those nine species are *M. caudata* Triana & Planchon, *M. eichleriana* Wittmack, *M. maguirei* de Roon, *M. weberbaueri* Gilg, and *M. sintenisii* Urban of subgenus *Plagiothalamium* (flowers angled on pedicels), and *M. atropunctata* de Roon, *M. comosa* K. Presl, *M. panamensis* S. Dressler, *M. serrae* de Roon of subgenus *Orthothalamium* (flowers erect on pedicels), but none of them matches this new species. The three known specimens of the new species share not only the abaxial punctations, but also rather large leaf dimensions and a round to subcordate base. The latter two characters are unique among all of the punctate-leaved species mentioned above. In its floral characters, the new species resembles *M. purpurea*, which occurs in the same area, but the leaves distinguish it clearly from that taxon.

Another rather unusual feature is the apparently cauliflorous inflorescence on rather long leafless lateral shoots (peduncles). I refer to the latter as "apparently,"as I have seen only two collections in reproductive state, both with a comparatively long, leafless peduncle greater than 13 cm long: The type collection is cauliflorous with the peduncles borne in leaf axils. The paratype from Brazil has a loose inflorescence only. The paratype from Venezuela is a sterile branch.

This cauliflory is not necessarily consistent within this taxon, so I hesitate to use this unique character for naming the new species. Only two other species in the Marcgraviaceae develop cauliflorous inflorescences on normal-leaved branches, namely *Sarcopera rosulata* de Roon & Bedell and *Schwartzia jimenezii* (Standley) Bedell.

Additionally, a long-pedunculate inflorescence is unusual within the genus *Marcgravia*, known only in *M. pedunculosa* Triana & Planchon, *M. nervosa* Triana & Planchon, and *M. roonii* S. Dressler, but there the inflorescences are terminal on the leaved branches.

This new taxon belongs to series *Brachyracheae* Wittmack of subgenus *Marcgravia* (syn. *Plagiothalamium* Delpino).

Marcgravia punctifolia S. Dressler, sp. nov. TYPE: Venezuela. Bolívar: Dist. Piar, Amaruay-tepui, S side about 1 km from SW corner, 5°54′N, 62°15′W, 550–810 m, 26 Apr. 1986, *Liesner & Holst 20367* (holotype, VEN; isotype, MO). Figure 1.

Haec species nova glandes plurimas fuscas punctiformes in foliorum paginis infernis habet et ad subgen. *Plagiothalamium* ser. *Brachyracheas* pertinet, i.e., propter flores obliquos ad pedicellos et rhachim non-elongatam. Folia elliptica comparate grandia (15–25 cm longa, 4–11 cm lata) basi rotundata ad cordatam. Praeter punctas numerosas et parem glandium basilaminarium glandes laminares non adsunt. Inflorescentiae conspicue pedunculatae (plus quam 13 cm longae) et cauliflores possunt.

Liana, fertile branches pendulous, grayish brown, terete, short-bristly. Leaves petiolate; petioles stout, subterete, adaxially ± deeply canaliculate, 5–9 mm long, 2–4 mm diam., adult blades relatively large, elliptic, 15–25 × 4–11 cm, apex acuminate, acute to obtuse, acumen up to 2 cm long, base round to cordate, margin entire, in sicco chartaceous to subcoriaceous, midrib slightly canaliculate above, prominent beneath, lateral veins obscure to subprominent above, subprominent beneath; hypophyllous glands—marginal: dark glandular dots in the margin (indentations) up to 1 mm long, ca. 2–4 mm distance in between, sometimes

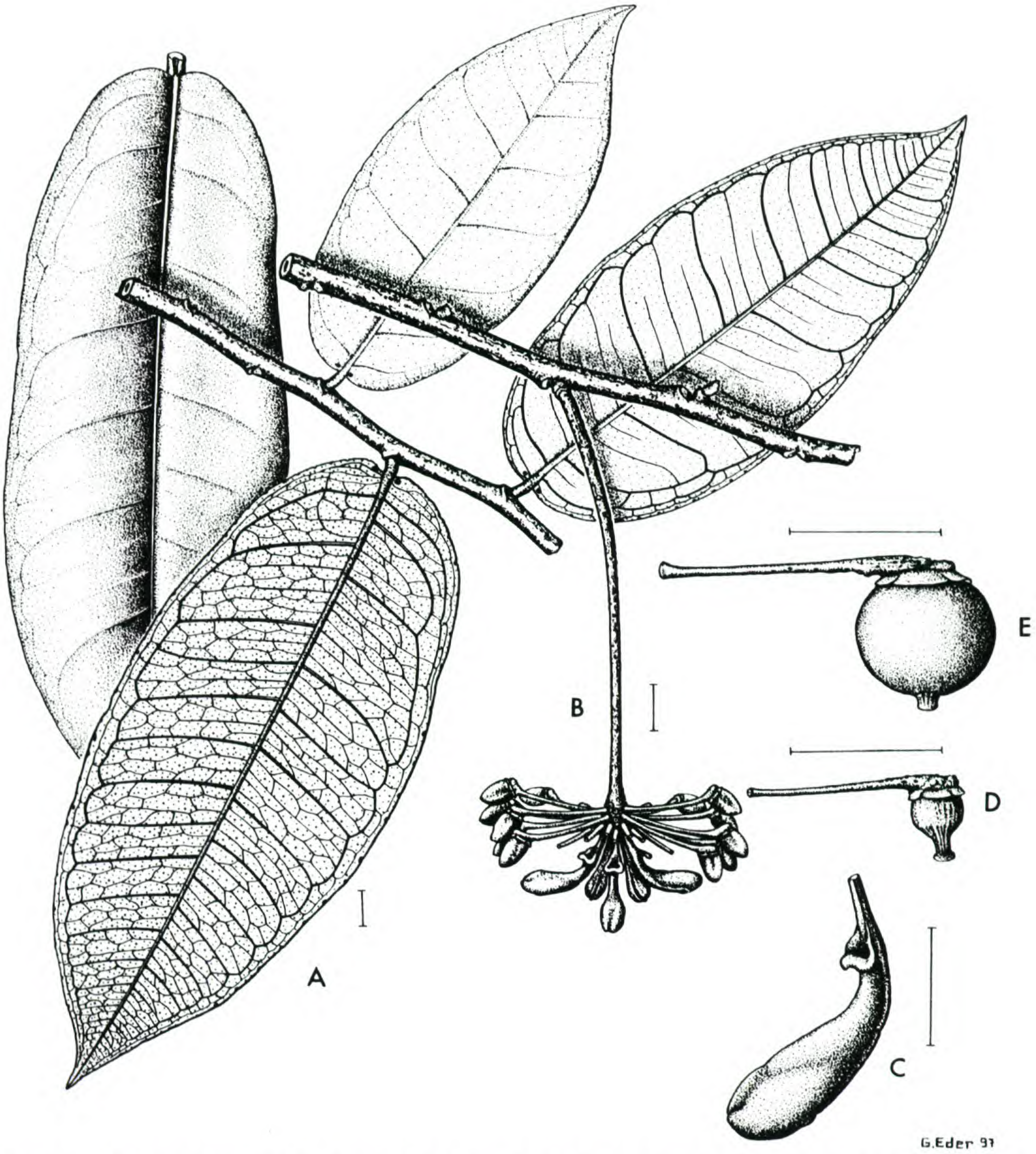


Figure 1. *Marcgravia punctifolia* S. Dressler. —A. Leaved branch. —B. Branch with cauliflorous inflorescence. —C. Nectary. —D. Flower after anthesis. —E. Fruit. A–D, *Liesner & Holst 20367*. E, *Prance, Steward, Ramos & Farias 10188*. Bars = 1 cm.

small, dark, oval, solid glands beside the margin, up to 0.5 mm long; basilaminar: inconspicuous, oval, poriform gland, up to 1 mm, with small perforation; no laminar ones, but numerous dark glandular spots scattered all over lower surface; juvenile leaves not seen. Inflorescence short-bristly, pendent, seemingly cauliflorous on leafless lateral shoots (on the type collection), with ca. 25–30 fertile and 5–6 sterile flowers (nectaries), the rachis obtusely clavate, 7–13 mm long, 5–9 mm diam. Nectaries pitcher-shaped, stalk ca. 5–8 mm long, subterete in cross section, cup tubular-clavate, terminal slightly testiform, 15–20 mm long, 4–5 mm diam., inflated part ca. 3 mm diam., orifice slightly protruding. Flowers oblique, nearly perpendicular on pedicels, the latter 2–3(–4 in fruit) cm long, 1–2 mm diam. Bracteoles directly subtending the calyx, sepaloid, 0.5–1 × 1.5–2 mm, broadly triangular. Sepals ± equal, 0.7–1.5 × 3–4 mm, oval to very broadly elliptic, very short, spreading, margin

thinned, irregular, without dark glandular spots. Corolla caps ovoid, apically asymmetrical, obtuse, 7–8 mm long, ca. 4 mm diam. basally. Stamens (not seen). Ovary globoid, (7?)8–9(–10?)-locular, apically bluntly acuminate (style), 2.5–3 mm diam., ca. 2.5 mm tall; style ca. 1.5 mm long, stigma 1.5 mm diam. Fruits globoid, 10–12 mm diam., 9–11 mm tall, roughish, stigma 1–1.5 mm tall, ca. 2 mm diam.

Distribution. Known from Cerro Marutani and Amaruay-tepui in Estado Bolívar, Venezuela; and Serra dos Surucucus, Territorio Roraima, Brazil; in montane rainforests at 500–1000 m elevation.

The epithet alludes to the conspicuously punctate lower surface of the relatively large but thinly elliptic leaves. Furthermore, it is characterized by the round to (sub)cordate base and the apparently cauliflorous inflorescence on rather long leafless lateral shoots (peduncles). This species seems morphologically closely related to *M. purpurea* because of its flower characters, but differs in leaf shape and punctation. There is also some similarity with *M. weberbaueri* from the Andes of Colombia, Ecuador, and Peru, which shares the punctate lower leaf, but has smaller, basally acute blades and much shorter peduncles terminal on shoots.

Paratypes. VENEZUELA. **Bolívar:** Dist. Heres, Cerro Marutani, cumbre, 3°50′N, 62°15′W, 900–1000 m, 11, 12 and 14 Jan. 1981, *Steyermark, Maguire, Brewer-Carías & Carreño 124077* (MO). BRAZIL. **Roraima:** Serra dos Surucucus, NW of Mission Station, 2°42–47′N, 63°33–36′W, *Prance, Steward, Ramos & Farias 10188* (U).

Acknowledgments. I thank Jan Frits Veldkamp, Doris Borchmeyer, and Horst Lange-Bertalot for help with the Latin diagnosis, Gundhild Eder for patience while preparing the illustration, Bert Vrijbloed and Gerard Thijsse for constructive help with the handling of the loans, and the staffs of the herbaria F, MO, NY, U, US, VEN for making the material available for study.

A New Combination in *Tarenna* (Rubiaceae) from Central Africa

Roy E. Gereau
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. To provide a valid name for the floristic checklist of the Ituri Forest (Democratic Republic of Congo), a new combination is made: *Tarenna gilletii* (De Wildeman & T. Durand) N. Hallé ex Gereau (Rubiaceae).

In proposing the combination *Tarenna gilletii* (De Wildeman & T. Durand) N. Hallé (Rubiaceae), Hallé (1970: 115) cited the basionym but gave no reference to its place of valid publication, page number, or date, thus failing to meet the requirements of ICBN Art. 33.2 (Greuter et al., 1994: 45) for valid publication of a new combination. Lebrun and Stork (1997: 230) listed the binomial with N. Hallé as the sole combining author and indicated the basionym, also without indicating its place of publication. The combination is validated as follows:

Tarenna gilletii (De Wildeman & T. Durand) N. Hallé ex Gereau, comb. nov. Basionym: *Chomelia gilletii* De Wildeman & T. Durand, Bull. Herb. Boissier, sér. 2, 1: 29. 1900. TYPE: Democratic Republic of Congo. Kisantu, *J. Gillet 149* (holotype, BR not seen).

Literature Cited

Greuter, W., F. R. Barrie, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva, P. Trehane & J. McNeill. 1994. International Code of Botanical Nomenclature (Tokyo Code). Regnum Veg. 131.

Hallé, N. 1970. Rubiacées (2ème partie). *In*: A. Aubréville & J.-F. Leroy (editors), Flore du Gabon 17: 1–335, Muséum National d'Histoire Naturelle, Paris.

Lebrun, J.-P. & A. L. Stork. 1997. Énumération des Plantes à Fleurs d'Afrique Tropicale, Vol. 4. Conservatoire et Jardin botaniques de Genève.

Deherainia lageniformis (Theophrastaceae), a New Species from Costa Rica

Jorge Gómez-Laurito
Escuela de Biología, Universidad de Costa Rica, Ciudad Universitaria 2060,
San José, Costa Rica

Nelson Zamora
Departamento de Botánica, Instituto Nacional de Biodiversidad, Apdo. 22-3100,
Santo Domingo, Heredia, Costa Rica

ABSTRACT. *Deherainia lageniformis* Gómez-Laurito & N. Zamora, from Costa Rica, is described, illustrated, and compared with its closest relative.

RESUMEN. Se describe de Costa Rica una nueva especie de *Deherainia* (Theophrastaceae), además se ilustra y se compara con la otra especie cercana.

Deherainia Decaisne (Theophrastaceae) is a small neotropical genus of much-branched treelets with chartaceous leaves and green flowers. According to the most recent account (Stahl, 1989), it comprises just two species: *D. matudae* Lundell, distributed from Chiapas to Guatemala, and *D. smaragdina* (Planchon ex Linden) Decaisne, ranging from Veracruz to Belize and Honduras. *Deherainia cubensis* (Radlkofer) Mez has been relegated to the monotypic genus *Neomezia* as *N. cubensis* (Radlkofer) Votsch, endemic to Cuba. A third species of *Deherainia* from the Cordillera de Tilarán and Cordillera de Guanacaste in northern Costa Rica is described below. This new record provides a considerable range extension of the genus from the nearest known locality in Honduras.

Deherainia lageniformis Gómez-Laurito & N. Zamora, sp. nov. TYPE: Costa Rica. Guanacaste: Cañas, Parcelas Nueva Guatemala, Estribaciones del Volcán Tenorio, 1000 m, 10°37′30″N, 85°00′45″W, 18 ene. 1994, *G. Herrera 6779* (holotype, USJ; isotypes, CR, F, INB, MO). Figure 1.

D. matudae affinis, praecipue differt foliis junioribus apice aristatis; foliis maturis ellipticis ad oblanceolatis, apice aristatis; floribus majoribus, corolla intra in medio lepidota et in tertio basale pilis glanduliferis provista, staminodiis ellipticis, apice truncatis; fructu ovato ad lageniformi, magno, apice aristato.

Trees 5–8 m tall with many branches. Branchlets stiff, angulate to terete, lepidote to glabrescent. Young leaves in 2 verticels around the nodes, 2–10 mm long, setaceous to lanceolate, with a spinelike mucro at the tip. Mature leaves subverticillate, 4 or 5 per node, when fresh with a mint odor of yerbabuena (*Haber et al. 11234*). Petioles 5–7 mm long, striate, glabrous, greenish yellow. Lamina elliptic to oblanceolate 12–22 × 4–6 cm, glabrous and with minute pits sparsely scattered on both sides, chartaceous, green above and greenish yellow beneath with the middle nerve prominent and lateral nerves slender, with numerous fine, strongly ascending and anastomosing strands of extraxyllary schlerenchyma, entire at the margins, acute at the apex with a short spinelike mucro, attenuate at the base. Inflorescence of 7 or 8 flowers inserted at the ends of the branchlets. Pedicels of mature flowers 25–30 mm long, striate, glabrous. Flowers to 25 mm long, campanulate, unpleasantly scented. Calyx 6–8 mm long, 5-parted, lobes broadly rounded at apex, green, imbricate, glabrous, irregularly dentate, erose and usually brownish at margin, persisting in fruit. Corolla 5-parted, lobes ca. 20 mm long, united basally in a 5-mm tube, elliptic to broadly elliptic, green, yellowish and involute at margin, with minute sunken glandular hairs in the middle, and gland-tipped hairs on the basal third, glabrous outside. Staminodia elliptic, about 2 mm long, obtuse to truncate at the apex, margins involute, sparsely lepidote and with minute gland-tipped hairs in the inner surface. Stamens 5, slightly exserted; filaments 4 mm long, slender, glabrous, flat, broad at base and connate into a very short tube; anthers ca. 2 mm long, suborbicular, truncate at apex, dorsifixed, 2-celled, longitudinally dehiscent. Ovary ovate, ca. 3 mm long; style 4 mm long, glabrous with a discoid stigma. Fruits green, pendulous, ovoid to flask-shaped, about 14 cm long and 7 cm broad, green, acute at the tip with

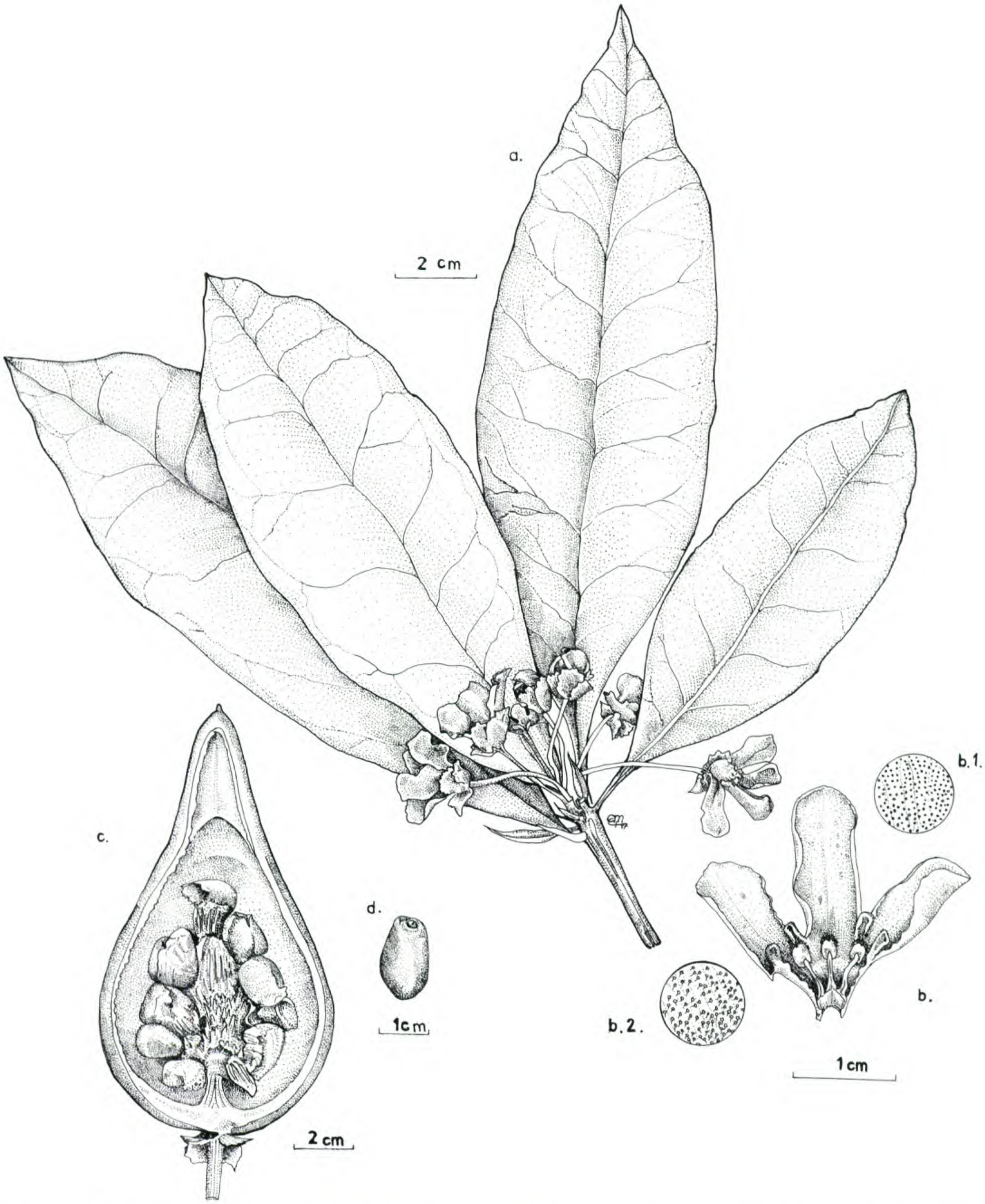


Figure 1. *Deherainia lageniformis* Gómez-Laurito & N. Zamora (*Herrera 6779*, USJ). —a. Flowering branch. —b. Dissected corolla; b.1. Sunken glandular hairs; b.2. Gland-tipped hairs (*Haber et al. 11234*, INB). —c. Dissected fruit. —d. Seed.

a spinelike mucro; pedicels 3–4 cm long, glabrous. Seeds 15 mm long, 10 mm wide, 7 mm thick, elliptic to broadly elliptic, flattened to rounded and irregularly angled, hard, finely rugose, cream, translucent, immersed in a mucilaginous whitish pulp.

Deherainia lageniformis is an uncommon endemic to Costa Rica on the Pacific slopes of the Volcán Tenorio in the Cordillera de Guanacaste (Guanacaste province) and the Atlantic slopes of the Cordillera de Tilarán in the Reserva Bosque Eterno de los Niños, San Carlos, and near the Reserva Biol-

ógica Alberto M. Brenes in San Ramón (Alajuela province) from 500 to 1000 m, in the biotic units described by Herrera and Gómez (1993) as "a-Templada, tropical muy húmeda sin meses secos. b-Subtropical, muy húmeda con 1–2 meses secos." It is closely related to *D. matudae* (Lundell, 1938) from which it differs particularly in having young leaves with a spinelike mucro; mature leaves with a short spinelike mucro at the tip; pedicels 25–30 mm long; large flowers (to 25 mm long) with an indumentum of two kinds of hairs in the inner corolla surface (sunken glandular hairs on the middle and gland-tipped hairs on the basal third); lobes elliptic to broadly elliptic with erose and involute margins; and staminodia elliptic, obtuse to truncate at the apex. The most striking feature is the large fruit (to 14 × 7 cm), which is ovate to flask-like at maturity (whence the specific epithet) with a spinelike tip.

Paratypes. COSTA RICA. **Alajuela:** Bosque eterno de los niños, 4 Km SO de La Tigra de San Carlos, Valle del Río La Esperanza, Finca Araya-Ledezma, 10°18′N, 84°37′W, 600–800 m, July 1992, *W. Haber et al. 11234* (INB, MO, USJ); San Ramón, Bajo Rodríguez, Río La Esperanza, Quebrada Mirasol, Finca Araya, 10°18′30″N, 84°35′W, 500–600 m, 10 mar. 1993, *Bello et al. 4852* (INB, MO, USJ); Los Chiles, Llanura de Los Guatusos, La Tigra, Finca Araya, 10°44′N, 84°43′W, 80 m, 18 Apr. 1989, *S. Schick 20* (INB).

Acknowledgments. We are grateful to Michael H. Grayum (Missouri Botanical Garden) for his critical reading of the manuscript and to Carmen Marín for the excellent illustration.

Literature Cited

Herrera, W. & L. D. Gómez. 1993. Mapa de Unidades bióticas de Costa Rica. Escala 1: 685.000. Instituto Geográfico de Costa Rica.

Lundell, C. L. 1938. Studies of Mexican and Central American Plants—IV. Amer. Midl. Naturalist 20: 236–242.

Stahl, B. 1989. A synopsis of Central American Theophrastaceae. Nordic J. Bot. 9: 15–30.

Triniochloa gracilis (Gramineae: Pooideae), a New Species from the Sierra Madre del Sur, Mexico, and a Key to the Species of the Genus

Maricela Gómez-Sánchez
Escuela de Biología, Universidad Autónoma del Estado de Querétaro, 76010 Querétaro, Querétaro, Mexico

Manuel González-Ledesma and Stephen D. Koch
Especialidad de Botánica, Instituto de Recursos Naturales, Colegio de Postgraduados, 56230 Montecillo, Edo. de México, Mexico

ABSTRACT. *Triniochloa gracilis*, a new species from the Sierra Madre del Sur in the Mexican states of Guerrero and Oaxaca, is described and illustrated. The new species is distinguished from all other species of the genus by its narrow panicles and short, equal glumes. A key to all of the known species of the genus is provided.

RESUMEN. Se describe e ilustra como especie nueva a *Triniochloa gracilis*, proveniente de los estados de Guerrero y Oaxaca en la Sierra Madre del Sur. La nueva especie es distinguida de todas las otras especies del género por las panículas estrechas y las glumas cortas e iguales. Se presenta una clave para todas las especies conocidas del género.

Triniochloa gracilis M. Gómez-Sánchez & M. González-Ledesma, sp. nov. TYPE: Mexico. Guerrero: Municipio de Heliodoro Castillo, 62 km de Filo de Caballo por terracería a Puerto del Gallo (7 km al oeste de El Jilguero), altitud 2790 m, 4 dic. 1993, *M. González-Ledesma & C. Catalán H. 553* (holotype, CHAPA; isotypes, CAS, ENCB, IEB, MEXU, MICH, MO, QMEX, TEX, US, XAL). Figure 1.

Plantae perennes, caespitosae, non rhizomatosae, innovationibus extravaginalibus. Culmi gracilis, erecti vel geniculati, 30–60 cm alti, 0.5–0.8 mm diametri. Laminae foliorum planae, infera redactae ad nullae. Panicula erecta, 5–12(–15) cm longa, 3–5 mm lata, rami adpressi. Spiculae cum glumis aequalibus vel subaequalibus, ¼–⅓ lemma longitudine; lemma 9–11(–12) mm longa, arista dorsale, 12–16 mm longa. Antherae 1.5–2.7 mm longae.

Plants caespitose, perennial, without rhizomes. Culms 30–60 cm tall, erect or geniculate at the base, very narrow, 0.5–0.8 mm diam., the upper nodes exposed. Innovations extravaginal. Leaf sheaths with thin, hyaline, fused margins and prominent nerves, glabrous to retrorsely scaberulous, the lower sometimes pilose, the upper shorter than their internodes. Ligules 2–5 mm long, membranaceous. Leaf blades flat, conduplicate to involute when dry, pilose on the upper surface, glabrous below, generally 10–15 cm long and 1.3–1.7 mm wide, very reduced or absent at the lowest 2 or 3 nodes. Panicle erect, narrow, 5–12(–15) cm long and 3–5 mm wide, with a total of 7–15(–38) spikelets, the lowest node with 1–5(–8) spikelets; branches and pedicels appressed and glabrous to scaberulous. Spikelets 1-floreted. Glumes equal to subequal, 1.8–3.0 mm long, mostly hyaline to hyaline only near the apex. Lemmas 9–11(–12) mm long, 7-nerved, with a dorsal awn 12–16 mm long inserted on the upper half. Callus hispid, the lateral hairs longer than the dorsal, sometimes exserted at the angle between the glumes, but shorter than the glumes. Lodicules truncate and fused. Anthers 3, 1.5–2.7 mm long. Caryopsis free, 4.8–6.0 mm long; hilum linear, as long as the caryopsis.

Distribution and habitat. *Triniochloa gracilis* is known only from the Sierra Madre del Sur in the Mexican states of Guerrero and Oaxaca, where it grows in pine and oak forests at an elevation between 2700 and 3100 m. At the three sites where it has been collected, it is locally common.

Triniochloa gracilis is distinguished from all other species of *Triniochloa*, except *T. stipoides*, by its very short, equal to subequal glumes. From *T. stipoides*, it is easily separated by its narrow, erect panicles, short leaf blades, and relatively small anthers. At the type locality it was growing together with *T. stipoides*, from which it is easily distinguished by its slender habit and narrow panicles.

Paratypes. MEXICO. **Guerrero**: Municipio de Leonardo Bravo, 12 km de Filo de Caballo por la terracería a Cruz de Ocote, altitud 2765 m, 3 dic. 1993, *M. González-Ledesma & C. Catalán H. 546* (ANSM, CHAPA, CII-

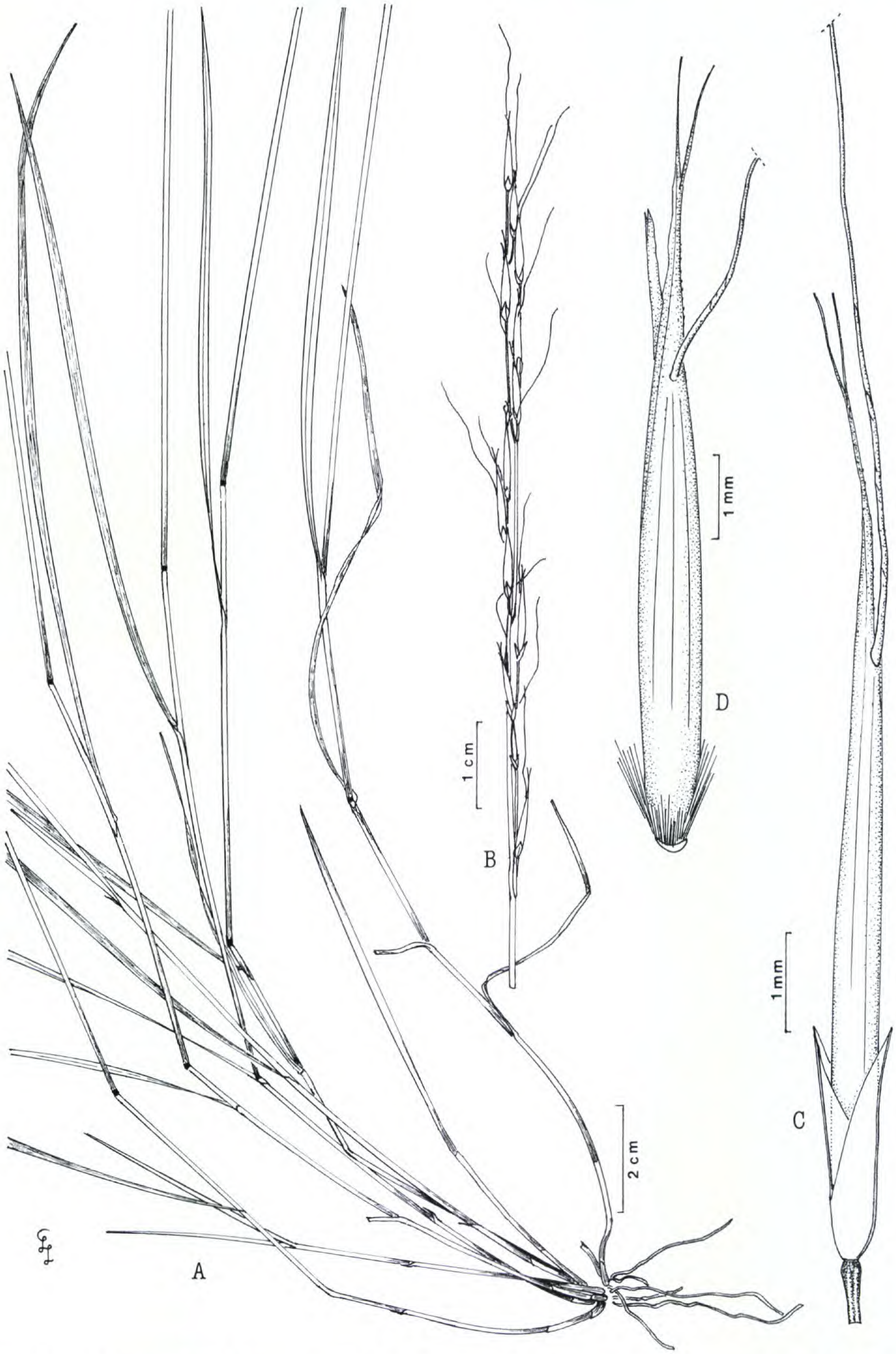


Figure 1. *Triniochloa gracilis* M. Gómez-Sánchez & M. González-Ledesma (*González-Ledesma & C. Catalán H. 533*). —A. Habit. —B. Panicle. —C. Spikelet. —D. Floret.

DIR, COCA, ENCB, IBUG, MEXU, MICH, QMEX, US). **Oaxaca:** Distrito de Miahuatlán, 27 km de San José del Pacífico por terracería a Santa María Ozolotepec (1 km adelante de la Cieneguilla), altitud 3100 m, 8 dic. 1993, *M. González-Ledesma & C. Catalán H. 566* (CHAPA, IEB, MO, QMEX).

The only existing key for the genus (Hitchcock,

1913) includes only the three species known from Mexico at the beginning of this century. Since that time, *T. andina*, from Venezuela (Luces de Febres, 1953), and *T. talpensis* (González-Ledesma et al., 1995) and the present *T. gracilis*, both from Mexico, have been published. Consequently, the following key is presented as a means of summarizing our current knowledge of the genus.

1a. Glumes much shorter than the lemma.
  2a. Panicle open, lax, the branches ascending to somewhat reflexed; glumes clearly unequal, the second 0.5–1.5 mm longer than the first and 4.5–6.0(–6.5) mm long; anthers (3.8–)4–6 mm long; leaf blades usually more than 15 cm long; widespread, from Mexico to Bolivia . . . . . *T. stipoides* (HBK) Hitchcock
  2b. Panicle narrow, erect, the branches and pedicels appressed; glumes equal or nearly so, the second less than 0.3 mm longer than the first and 1.8–3.0 mm long; anthers 1.5–2.7 mm long; leaf blades 15 cm or less long; Oaxaca and Guerrero, Mexico . . . . . *T. gracilis* M. Gómez-Sánchez & M. González-Ledesma
1b. Glumes, at least the second, as long as the lemma or nearly so.
  3a. Leaf blades less than 2 mm wide; plants not rhizomatous.
    4a. Ligule up to 10 mm long; panicle branches 3–4 at most nodes, at least some with 2–3 spikelets; known only from Morelos, Mexico . . . . . *T. micrantha* (Scribner) Hitchcock
    4b. Ligule 15 mm long, panicle branches 1–2 per node, each with only 1 spikelet; known only from Mérida, Venezuela . . . . . *T. andina* Luces
  3b. Leaf blades 3–5 mm wide; plants rhizomatous.
    5a. Panicles less than 15 cm long, with fewer than 20 spikelets; leaf blades persistent after drying; rhizomes 0.8–1 mm diam.; known only from Chihuahua, Mexico . . . . . *T. laxa* Hitchcock
    5b. Panicle more than 15 cm long, with more than 30 spikelets; leaf blades, at least the basal ones, deciduous upon drying; rhizomes 2–3 mm diam.; known only from Jalisco, Mexico . . . . . *T. talpensis* M. González-Ledesma & M. Gómez-Sánchez

Acknowledgments. The first and third authors join with the second author in thanking M. C. Cesario Catalán H., of the Escuela Superior de Agricultura of the Universidad Autónoma de Guerrero, for his guidance, assistance, and company in the field with the second author.

Literature Cited

González-Ledesma, M., M. Gómez-Sánchez, S. D. Koch & T. Mejía- Saules. 1995. *Triniochloa talpensis* (Poaceae: Pooideae), a new species with deciduous leaves from Mexico. Novon 5: 36–39.

Hitchcock, A. S. 1913. Mexican grasses in the U.S. National Herbarium. Contr. U.S. Natl. Herb. 17: 181–389

Luces de Febres, Z. 1953. Especies de gramíneas nuevas para la ciencia. Bol. Soc. Venezolana Cienc. Nat. 80: 3–29.

Two New Species of *Festuca* (Gramineae: Pooideae) from Mexico

Manuel González-Ledesma and Stephen D. Koch
Especialidad de Botánica, Instituto de Recursos Naturales, Colegio de Postgraduados, 56230 Montecillo, Edo. de México, Mexico

Maricela Gómez-Sánchez
Escuela de Biología, Universidad Autónoma del Estado de Querétaro, 76010 Querétaro, Mexico

ABSTRACT. Two new species of *Festuca* from Mexico are described and illustrated: *F. roblensis*, from the states of Guanajuato and Zacatecas, and *F. valdesii*, from the Sierra Madre Oriental in the states of Coahuila, Nuevo León, and Tamaulipas.

RESUMEN. Se describen e ilustran dos especies nuevas de *Festuca* de México: *F. roblensis*, de los estados de Guanajuato y Zacatecas, y *F. valdesii*, de la Sierra Madre Oriental en los estados de Coahuila, Nuevo León y Tamaulipas.

In the course of continuing studies of *Festuca* in Mexico, the following two novelties were discovered.

Festuca roblensis M. González-Ledesma, sp. nov. TYPE: Mexico. Zacatecas: Municipio de Jeréz, Rancho El Roble, 19 km de El Derramadero por terracería a Monte de los García, altitud ca. 2800 m, 7 Sep. 1993, *M. González-Ledesma & J. García P. 530* (holotype, CHAPA; isotypes, ANSM, ENCB, IBUG, IEB, MEXU, MICH, MO, TEX, US). Figure 1.

Planta caespitosa, non rhizomatosa; innovationibus intravaginalibus. Culmi 100–130 cm alti, 1.6–2.6 mm diametri. Ligulae foliorum (1.3–)3.0–5.0 mm longae. Laminae foliorum planae, 30–55 cm longae, 1.5–3.6 mm latae, blandae, curvatae et longe attenuatae apicem versus. Panicula laxa, 16–26 cm longa. Spiculae (13–)14–19(–20) mm longae, 3–5(–6) floribus. Glumae inaequales, ⅓ vel minus spicula longitudine, gluma infera (2.5–)3.5–4.5(–4.8) mm longa, gluma supera (3.8–)4.0–5.5(–6.0) mm longa, haec flosculum tertium attingens. Lemmae (9.7–)10.0–12.5(–12.7) mm longae, aristae (0.5–)1.0–3.0(–3.7) mm longae. Antherae (4.0–)4.8–5.5 mm longae. Ovarium glabrum.

Plant densely caespitose, without rhizomes; innovations intravaginal. Culms erect, 100–130 cm tall, glabrous or sometimes scaberulous beneath the panicle, the lowest elongated internode 1.6–2.6 mm diam., the uppermost 2 nodes exposed. Leaf sheaths glabrous to scaberulous or scabrous apically, the margins hyaline toward the apex and continuous with the ligule; auricles absent; fibers of the old, basal sheaths persistent. Ligules hyaline, lacerate, (1.3–)3.0–5.0 mm long on the 3 uppermost leaves. Leaf blades 30–55 cm long, 1.5–3.6 mm wide, lax, flat to loosely involute when dry, long-attenuate, involute and curved toward the apex; adaxial surface glabrous, with low ribs; abaxial surface glabrous to scabrous, the midrib prominent. Panicle 16–26 cm long, open, lax, the axis rounded and glabrous below, angular and scaberulous or scabrous above; branches scaberulous to scabrous; lowermost node with 2 branches and a total of (5–)7–14 spikelets; pedicels (3–)4–8 mm long. Spikelets (13–)14–19(–20) mm long, with 3–5(–6) florets, the rachis scabrous. Glumes unequal, with broad, hyaline margins, ⅓ or less as long as the spikelet, the lower 1-nerved, (2.5–)3.5–4.5(–4.8) mm long, the upper 3-nerved, (3.8–)4.0–5.5(–6.0) mm long, not surpassing the base of the third floret. Lemmas of the 2 lower florets (9.7–)10.0–12.5(–12.7) mm long, glabrous to scaberulous or scabrous toward the apex, with a terminal awn (0.5–)1.0–3.0(–3.7) mm long. Palea hyaline except the nerves, shorter than the lemma. Lodicules 1.0–1.5 mm long, irregularly bifid. Anthers (4.0–)4.8–5.5 mm long. Ovary apex glabrous. Caryopsis 5.5–7.0 mm long, the hilum linear.

Leaf blade cross section. Blades flat or shallowly V-shaped; adaxial ribs low and rounded; adaxial furrows shallow to moderately deep; bulliform cells conspicuous; vascular bundles 16, the first-order bundles closer to the adaxial than to the abaxial surface; sclerenchyma girders present above and below all bundles.

Abaxial leaf blade epidermis. Costal and intercostal zones differentiated; intercostal long cells 15–20 times longer than wide, with thin, slightly undulating walls; stomata few, restricted to the intercostal zone; intercostal prickles widely scattered,

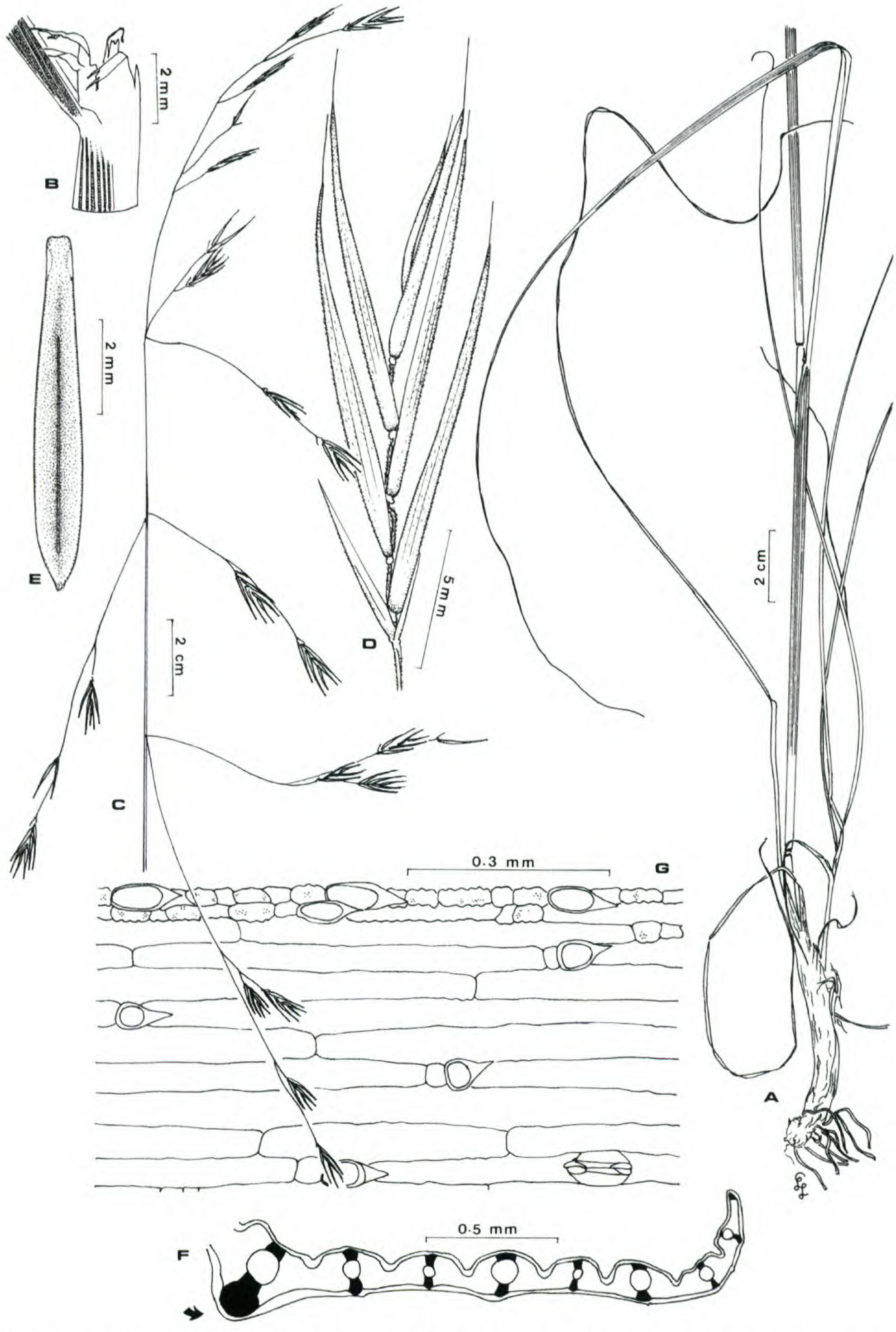


Figure 1. *Festuca roblensis* M. González-Ledesma. —A. Basal portion of a culm. —B. Ligule. —C. Panicle. —D. Spikelet. —E. Caryopsis. —F. Leaf blade cross section. Arrow indicates midrib. —G. Abaxial leaf blade epidermis. Based on *M. González-Ledesma & J. García P. 530* (CHAPA).

with round to ovate bases; costal prickles more frequent, with elongated bases; silica and cork short-cell pairs in rows in the costal zone, silica bodies mostly horizontally elongated.

Distribution and habitat. *Festuca roblensis* is known only from the type locality in Zacatecas and from San Felipe, Guanajuato, where it was found in oak woods between the elevations of 2440 and 2800 m.

Etymology. The specific epithet refers to the type locality, the El Roble ranch.

Festuca roblensis is a member of a group of species related to *F. lugens* (E. Fournier) Hernández X. With these species it shares well-developed ligules, flat leaf blades, and awned lemmas. The principal morphological characteristics that distinguish the new species from the others in the group are the very narrow (1.5–3.6 mm), lax (not rigid) leaf blades; relatively thin (less than 3 mm diam.) culms; and the small (less than 6 mm long) second glumes. With respect to leaf blade anatomy, *F. roblensis* has several characters which, although they are found in other species, are unusual in the group, and do not occur in this particular combination in any other species. In the cross section, these are the low, inconspicuous adaxial ribs, well-developed bulliform cells, and the displacement of the first-order vascular bundles toward the adaxial surface. In the epidermis, they are the well-differentiated costal and intercostal zones, the horizontally elongated silica bodies, and the presence of stomata.

Paratypes. MEXICO. **Guanajuato:** Municipio de San Felipe, Club Campestre El Vergel de la Sierra, altitud 2440 m, 3 Sep. 1981, *R. Guzmán 4531* (COCA); 39 km al NE de León, sobre la carretera a San Felipe, altitud 2500 m, 13 Aug. 1990, *J. Rzedowski 49861* (CHAPA, IEB).

Festuca valdesii M. González-Ledesma & S. D. Koch, sp. nov. TYPE: Mexico. Coahuila: Municipio de Arteaga, Sierra de Zapalinamé, altitud 3015 m, 19 May 1990, *J. Hinton et al. 20278* (holotype, CHAPA; isotypes, CHAP (panicle only), IEB). Figure 2.

Planta caespitosa, non rhizomatosa; innovationibus intravaginalibus et extravaginalibus. Culmi 80–130 cm alti, ascendentes. Ligulae foliorum minores quam 1 mm longae. Laminae foliorum planae, 25–35 cm longae, 2.4–4.0 mm latae, rigidae, non longe attenuatae apicem versus. Panicula laxa, 17–25 cm longa, nodus inferus cum 1–2 ramis et (6–)15–25 spiculis. Spiculae (8.0–)9.0–13.5(–14.3) mm longae, (2–)3–5 floribus. Glumae inaequales, spiculam ½ superans ad fere aequans, gluma infera (4.0–)4.5–7.0(–8.3) mm longa, gluma supera (4.6–)5.0–8.5(–10.1) mm longa, haec flosculum ultimum attingens. Lemmae (6.2–)7.0–9.5(–9.9) mm longae, carinatae apicem versus, absque arista. Antherae 2.8–3.5 mm longae. Ovarium hispidum.

Plant glaucous, densely caespitose, without rhizomes; innovations intra- and extravaginal. Culms ascending, 80–130 cm tall, the lowest elongated internode 1.5–3.0 mm diam., the uppermost 2–3 nodes exposed. Basal leaves mostly dead at anthesis. Leaf sheaths glabrous to scaberulous; fibers of the old, basal sheaths persistent; auricles absent. Ligules membranaceous, truncate, short-ciliate, less than 1 mm long. Leaf blades 25–35 cm long, 2.4–4.0 mm wide, firm-textured, flat, loosely involute or convolute when dry, short-attenuate; adaxial surface scaberulous, with moderately prominent ribs; abaxial surface scaberulous. Panicle 17–25 cm long, open, lax, the axis glabrous below, scabrous above, terminating with 2–3, closely placed spikelets; lowest node with 1–2 branches and a total of (6–)15–25 spikelets. Spikelets (8.0–)9.0–13.5(–14.3) mm long, with (2–)3–5 florets. Glumes unequal, more than ½ as long as to nearly equaling the spikelet, scabrous only toward the apex and along the midrib, the lower (4.0–)4.5–7.0(–8.3) mm long, the upper (4.6–)5.0–8.5(–10.1) mm long, surpassing the base of the uppermost floret. Lemmas of the 2 lower florets (6.2–)7.0–9.5(–9.9) mm long, scaberulous to scabrous, with 3 or 5 prominent nerves, awn absent. Lodicules entire, not bifid. Anthers 2.8–3.5 mm long. Ovary apex hispid. Caryopsis about 4 mm long, hilum linear.

Leaf blade cross section. Blades flat; adaxial ribs rounded, moderately prominent; adaxial furrows moderately deep; bulliform cells conspicuous; vascular bundles 19, the first-order bundles equidistant from both surfaces or somewhat closer to the adaxial surface; sclerenchyma girders present above and below all bundles.

Abaxial leaf blade epidermis. Costal and intercostal zones differentiated; intercostal long cells 4–20 times longer than wide, with thin to thick, slightly to strongly undulating walls; stomata few to absent; intercostal prickles very few or absent; costal prickles abundant, with ovate to elongate bases; silica and cork short-cell pairs abundant in both zones, vertically elongated (occasionally square) in the intercostal zone, square to horizontally elongated in the costal zone.

Distribution and habitat. *Festuca valdesii* is native to the northern Sierra Madre Oriental in the states of Coahuila, Nuevo León, and Tamaulipas. It grows at elevations of 2600–3400 m in forests with *Pseudotsuga, Picea, Abies, Pinus,* or *Cupressus.*

Etymology. This new species is named in honor of Jesús Valdés Reyna, the person who best knows

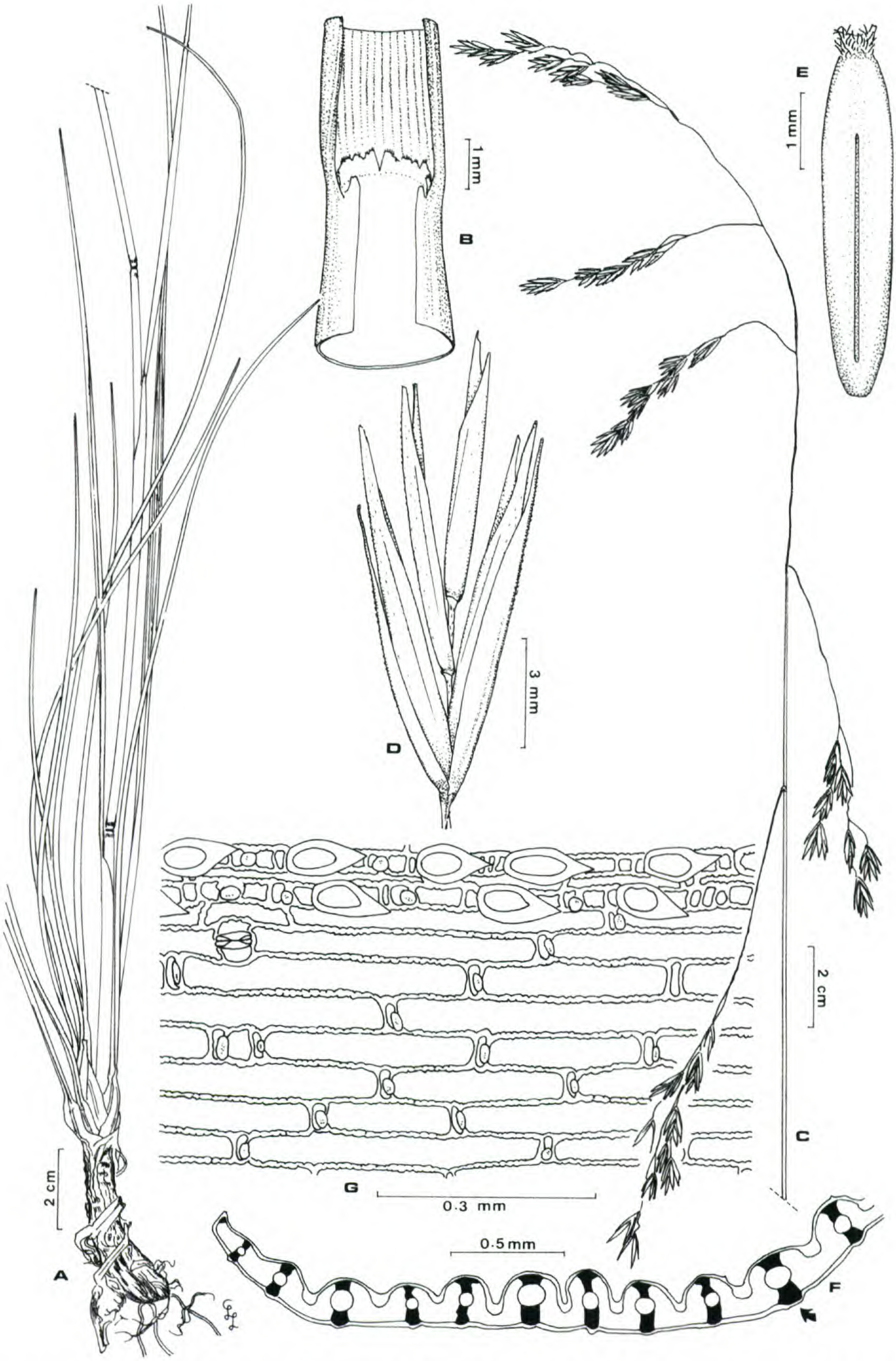


Figure 2. *Festuca valdesii* M. González-Ledesma & S. D. Koch. —A. Basal portion of a culm. —B. Ligule. —C. Panicle. —D. Spikelet. —E. Caryopsis. —F. Leaf blade cross section. Arrow indicates midrib. —G. Abaxial leaf blade epidermis. A & B based on *J. Hinton et al. 20278* (CHAPA); others based on *M. González-Ledesma & J. García P. 697* (CHAPA).

the grasses of the northern Sierra Madre Oriental and who kindly sent us the first specimens of this species.

This species has been confused with *F. amplissima* Ruprecht ex E. Fournier because of its large size, flat leaf blades, and open, lax panicles. In addition, both species grow in humid conifer forests. It can be distinguished from the latter species on the basis of its glaucous foliage, short-attenuate (not long-attenuate) leaf blades, which are 25–35 cm long and 2.4–4.0 mm wide [not 30–60(–95) cm long and (3.5–)4–12(–16) mm wide]; its smaller panicles [17–25 cm, not (20–)25–35 cm long] with 1–2 branches and a total of (6–)15–25 spikelets at the lowest node [not 2–4(–5) branches and a total of 25–70(–200) spikelets]; and its ovaries, which are hispid (not glabrous) at the apex.

The geographic distribution of this species includes the state of Tamaulipas, even though no specimens are cited. The basis for this is that the two collections from Cerro Peña Nevada (*González-Ledesma & García 697* and *702*) were made from populations that extend across the boundary between Nuevo León and Tamaulipas. The specimen labels arbitrarily atribute the collections to Nuevo Leon to facilitate future data management.

Paratypes. MEXICO. **Coahuila:** Municipio de Arteaga, Sierra de la Marta, 14 km de San Antonio de las Alazanas por camino a Mesa de las Tablas, altitud 2700 m, 2 Oct. 1986, *M. González-Ledesma & S. D. Koch 232* (CHAPA); 25°14′20″N, 100°28′00″W, altitud 2600 m, 26 Aug. 1975, *J. Passini & M. F. Robert 4295* (ENCB, MO not seen); El Picacho, parte superior de la Sierra de Zapalinamé, aproximadamente 3.5 km al SE de Saltillo, altitud 2600–2800 m, 29 Sep. 1980, *R. López A. & S. A. González s.n.* (ANSM 2 specimens). **Nuevo León:** Municipio de Rayones, Sierra de la Marta, El Cedral, altitud 3200 m, 6 Sep. 1994, *J. A. Villarreal 7906* (ANSM); Municipio de Ignacio Zaragoza, cerro Peña Nevada, altitud 3300 m, 3 Oct. 1994, *M. González-Ledesma & J. García P. 697* (CHAPA); altitud 3400 m, 3 Oct. 1994, *M. González-Ledesma & J. García P. 702* (CHAPA).

Acknowledgment. We thank the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) for financing part of the fieldwork (Project P076).

New Species and Notes on the Natural History of *Markea* (Solanaceae) from Colombia and Ecuador

Sandra Knapp

Department of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD, U.K.

ABSTRACT. Three new species of *Markea*, *M. antioquiensis*, *M. epifita*, and *M. pilosa*, are described, having been discovered as a result of revision of material for the *Checklist of the Vascular Plants of Ecuador*. The relationships of these new taxa to the previously described Colombian endemic *Markea lopezii* Hunziker and the recently described *M. spruceana* Hunziker, and the status of the genus *Markea* s. str., are discussed. An amplified description is provided for *M. spruceana* with notes on its natural history. The three new taxa are illustrated, and a distribution map with all four taxa is provided.

In the course of preparing the treatment of the Solanaceae for the *Checklist of the Vascular Plants of Ecuador* (Jørgensen & León Y. (editors), in prep.), several unusual specimens of epiphytic Solanaceae were encountered. I have noted that these specimens were in existence (Knapp et al., 1997; noted without names or citations), but have not until now had enough material to permit complete species descriptions. Recent collecting in the middle elevations of both Andean slopes in Ecuador has resulted in more complete material.

All of the taxa described here are allied with *Markea lopezii* Hunziker of Andean Colombia, sharing with it membranous leaves often with trichomes on both surfaces, elongate inflorescences, tubular funnelform corollas, winged pedicel apices, and large, membranous calyx lobes. *Markea lopezii* was treated as *taxon incertae sedis* in Knapp et al. (1997), and its true relationships are not clear. In the cladistic analysis in Knapp et al. (1997), it was the sister taxon to the genus *Solandra*, due in large part to its possession of large, orange flowers and to the large amount of missing data for it (and its relative *M.* aff. *lopezii*, described recently as *M. spruceana* Hunziker) in the data matrix. Missing data can seriously affect the placement of taxa in cladistic analyses, so the placement of *M. lopezii* and *M. spruceana* should be treated with caution. *Markea lopezii*, *M. spruceana*, plus the species described here clearly form a natural group, but whether they in fact represent a new genus allied to *Markea* awaits analysis of further collections of both flowering and fruiting material.

Current generic limits in *Markea* are unclear, with several genera having been split from it (e.g., *Hawkesiophyton* Hunziker and *Schultesianthus* Hunziker; see Hunziker, 1979), and with the genus being defined in its traditional sense on the basis of its strictly basifixed anthers, imbricate or cochlear imbrication, and often laciniate calyx lobes (Hunziker, 1979), all of which can be variable in the taxa concerned (see Knapp et al., 1997). Knapp et al. (1997) identified a clade with several seed-based synapomorphies consisting of *Markea* in the traditional sense plus the segregate genus *Hawkesiophyton*. The seeds are not known from *M. lopezii* or from two of the four species treated here. Hunziker (1997), in describing *M. spruceana*, noted that fruit and seeds were not known. As I have on loan to me from Ecuadorian herbaria several specimens of this species in fruit, I provide a complete description of this little known taxon here (also see species discussion). The fruit and seeds of *Markea* s. str. (as defined in Knapp et al., 1997) are distinctive: the fruit is a berry with thin, chartaceous pericarp that dries translucent, and the seeds are pale tan or orange with elongate, rectangular testal cells. Pollen of *Markea* s. str. is quite diverse, with three main pollen types being present in the genus (Persson et al., 1994). The pollen of *M. lopezii* with its spiny supratectal processes is completely anomalous in the tribe Juanulloeae and may be related to pollination syndrome (see Ferguson & Pearce, 1986). Hunziker's (1997) amplified concept of *M. lopezii* included taxa with and without what he calls "equinada" (echinate: more correctly the tectum bears spiny supratectal processes; truly echinate pollen is not found in the Solanaceae) exine, a result that needs confirmation and documentation. Preliminary examination of the pollen of two of the new species described here, *M. antioquiensis* and *M. pilosa*, indicates that pollen of *M. antioquiensis* is superficially similar to the *Markea sessiliflora* type and that of *M. pilosa* similar to the *Markea camponoti* type (pollen types sensu Persson et al.,

1994), but further studies are necessary (Persson, pers. comm.).

It is clear that the genus *Markea* is in dire need of a monograph based on detailed field observations and new collections, as so few specimens exist and detailed morphological study will require more than a single flower per sheet. I have chosen to describe these taxa in the genus *Markea* rather than erecting a new genus because these decisions will require intensive, field-based work. In order to stimulate further collecting and study of these interesting and seemingly relatively rare species, and so that some of the names can be used in the *Checklist of the Vascular Plants of Ecuador,* they are described here.

Markea antioquiensis S. Knapp, sp. nov. TYPE: Colombia. Antioquia: Municipio Frontino, corregimiento Nutibara, cuenca alta del Río Cuevas, 1780 m, 23 Sep. 1987, *Sánchez et al. 1559* (holotype, MEDEL; isotype, NY). Figure 1a, b.

Species *M. lopezii* Hunziker affinis, sed foliis maioribus basi truncatis vel rotundatis, glabris, calycis lobis magnis valde membranaceis, corolla eburnea lobis pupureis, difert.

Epiphytic shrub, hemiepiphytic liana or small treelet, to 2 m; stems fleshy and flexible, glabrous; older stems with thin, papery bark, drying a pale orange green color. Leaves apparently verticillate in whorls of ca. 6, elliptic to ovate, (4)10–25 × (8)10–45 cm, glabrous adaxially, minutely papillate abaxially with tiny glandular (?) trichomes ca. 0.02 mm long, drying brownish; major veins 6–7 pairs, drying brown abaxially; base truncate to rounded; apex acute, somewhat acuminate at the very tip; petiole 1.5–6 cm long, glabrous. Inflorescence an axillary raceme-like cyme, 4–10 cm long, usually bearing 4–10 flowers, the axis unbranched, glabrous or with a few scattered simple uniseriate trichomes ca. 1 mm long composed of 2–3 cells, these denser distally, each flower with 2 associated linear, stipule-like bracts 0.7–1 cm long, these sparsely pubescent with simple, uniseriate trichomes, the bracts soon deciduous. Buds elongate, corolla aestivation cochlear. Flowers with the calyx lobes valvate in bud, soon free in the distal half, the sutures winged onto the pedicel, divided ca. ½ way to the base at anthesis, the lobes elliptic, 1.5–3 × 5–7 cm, white or cream, membranous and expanded with the venation prominent, papillate with trichomes like those of the leaves, the tips rounded with a tiny apical point; pedicel 1–1.5 cm long, papillate like the calyx, winged at the apex from the calyx lobe sutures; corolla 7–9 cm long, funnelform, abruptly widening ca. 1 cm from the base and then gradually widening to the lobes, slightly more expanded distally, cream with reddish purple lobes, the tube 6–8 cm, purple at the base, the lobes 5, 1–1.5 × 1–2 cm, rounded, glabrous; filaments inserted ca. 1.2 cm from the base of the corolla tube, 2.5–3 cm long, with a few (i.e., ca. 4) uniseriate trichomes at the point of insertion, otherwise glabrous; anthers elongate, 1.8–2.3 cm × 1.5 mm, basifixed; ovary conical, glabrous, with a large, purple disk; style 4.5–5 cm long, abruptly broadening to the capitate stigma, glabrous. Fruit an elliptic berry, 3.5–4 × ca. 2 cm, green or yellowish green when ripe, the pericarp drying thin and papery, translucent; seeds ca. 100, rectangular, 3–3.5 × 1.5–2 mm, orangish yellow, the surfaces with square to rectangular pits, the hilum at one end.

Distribution. In premontane forests in northwestern Colombia on the western slopes of the Cordillera Occidental, in the department of Antioquia, at 1300–2000 m (Fig. 2).

Markea antioquiensis has been annotated as belonging to the family Gentianaceae, due probably to its large, thick leaves and showy flowers (also see below for *M. pilosa*). It is clearly a member of the genus *Markea* s. str., sharing with other members of the genus thin-walled berries filled with rectangular, orangish seeds. The calyx lobes in *M. antioquiensis* are the largest relative to the flower of any described species of *Markea,* and are striking in their thin and membranous texture. All parts of the plant, with the exception of the adaxial leaf surfaces, are sparsely covered with minute papillate trichomes, which dry a dark reddish brown. These sorts of trichomes are common in the genus, but are usually mixed with larger, simple uniseriate trichomes. Hunziker (1997) reported that they are glandular, but I have seen no obvious secretions.

Markea antioquiensis is most similar to *M. pilosa* of northern coastal Ecuador and adjacent Colombia. It shares with that species large, thick leaves with variously truncate bases, small stipule-like bracts subtending each flower, and extremely large membranous calyx lobes which invest the flower and fruit. It differs from that species in its consistently glabrous leaves, inflorescence axis with only a few scattered trichomes, and relatively larger calyx lobes.

The specific epithet refers to the province of collection, Antioquia.

Paratypes. COLOMBIA. **Antioquia:** Muncipio Urrao, Parque Nacional Natural Las Orquideas, sector Calles,

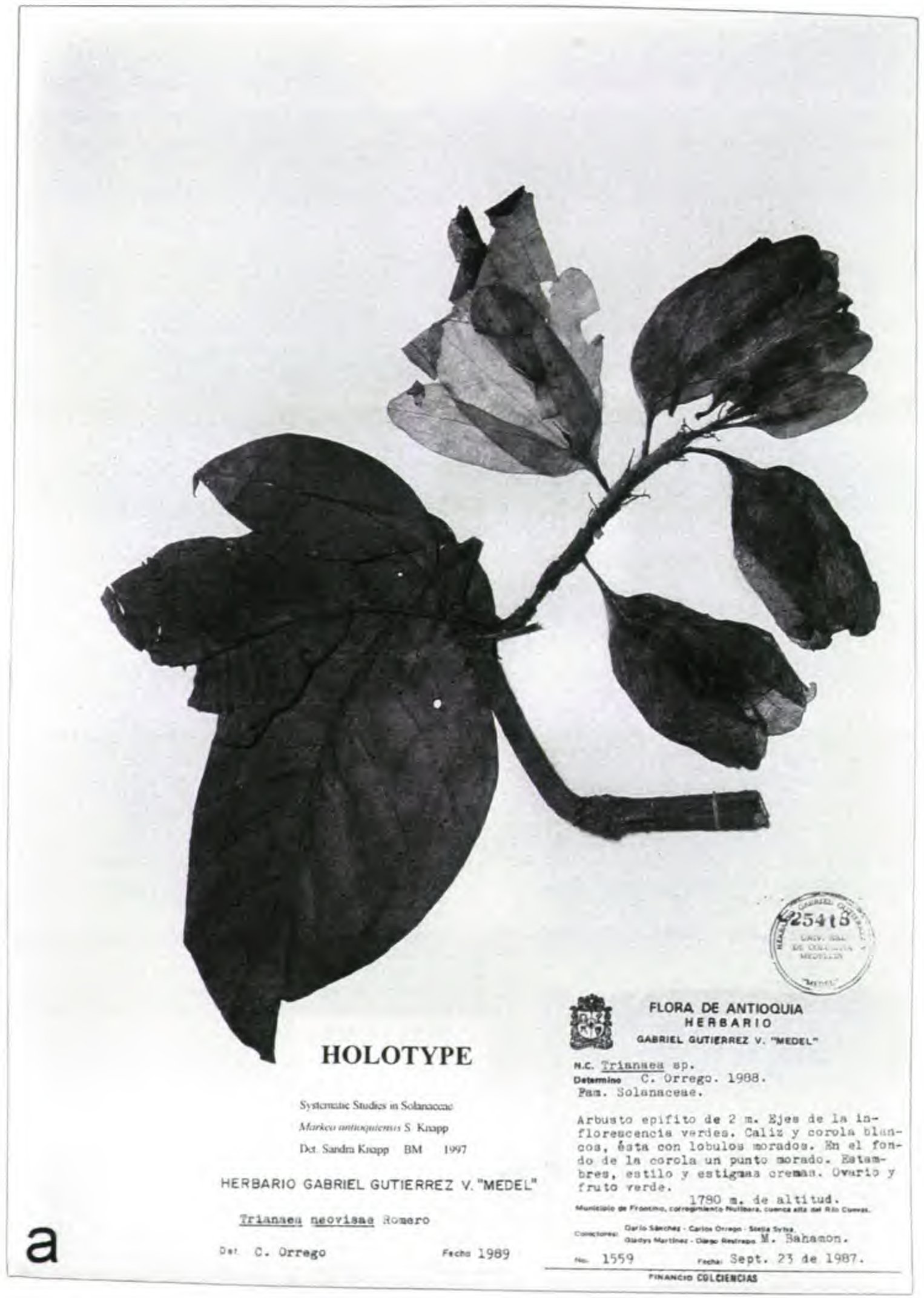


Figure 1. *Markea antioquiensis* S. Knapp.—a. Holotype, *Sánchez et al. 1559* (MEDEL).—b. Isotype, *Sánchez et al. 1559* (NY).

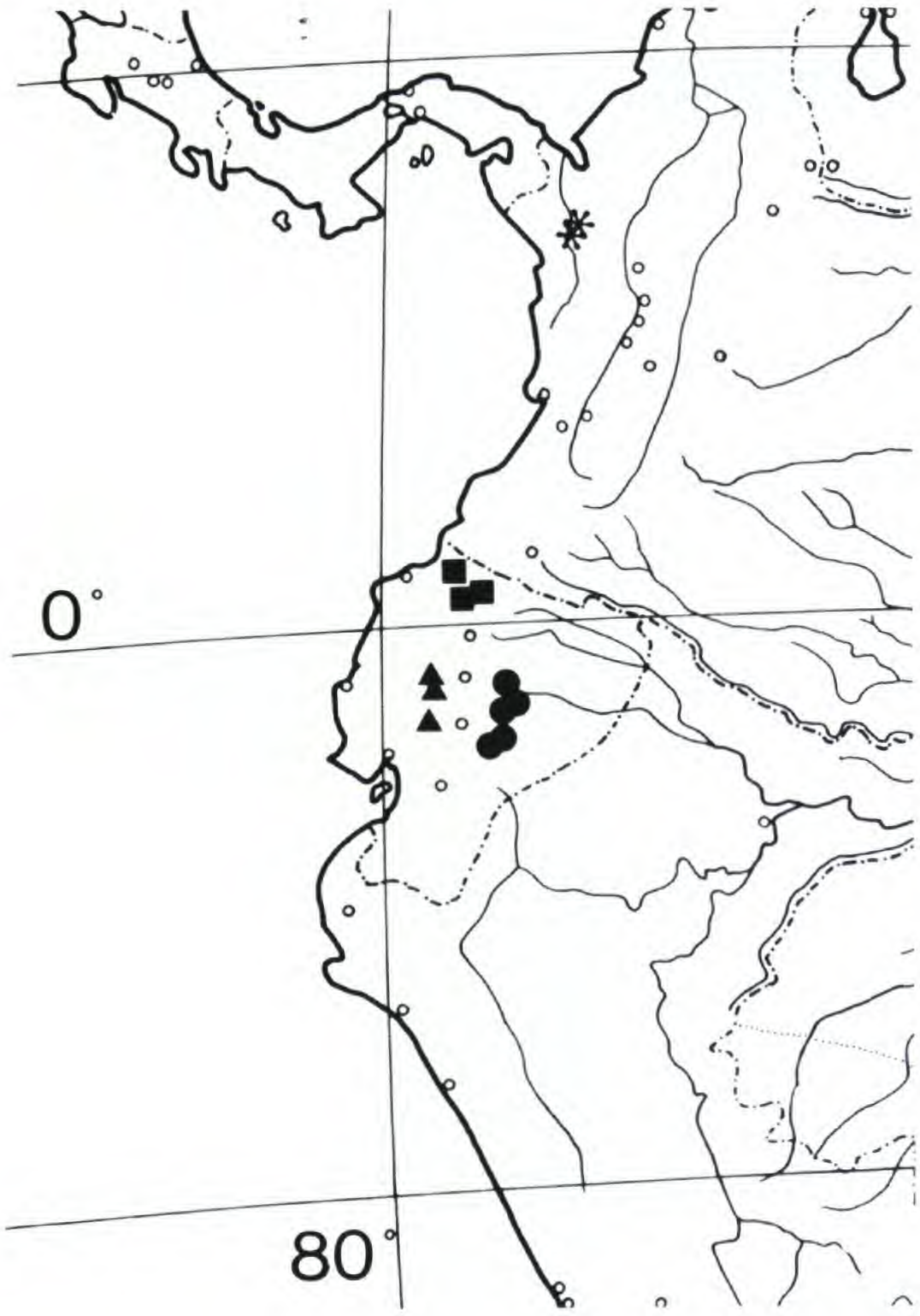


Figure 2. Distribution of *M. antioquiensis* (asterisks), *M. epifita* (circles), *M. pilosa* (squares), and *M. spruceana* (triangles).

margen izquierda Quebrada El Guaguo y margen derecho del Río Calles, 1350–1450 m, 6°32′N, 6 July 1991, *Cogollo et al. 5019* (MO); Municipio Frontino, region of Murrí, ca. 13 road km from Nutibara, NW of road, 2000 m, 6°40′N, 76°20′W, 10 Dec. 1988, *McPherson 13420* (MO, NY); Municipio Frontino, corregimiento Nutibara, cuenca alta del Río Cuevas, 1900 m, 17 Apr. 1987, *Sánchez et al. 1263, 1264* (MEDEL, MO).

Markea epifita S. Knapp, sp. nov. TYPE: Ecuador. Napo: Canton Archidona, carretera Hollín–Loreto, km 25, sector Challua Yacu, faldas al S de Volcán Sumaco, 1200 m, 1°45′S, 77°38′W, *Cerón & Hurtado 6534* (holotype, QCNE; isotypes, MO not seen, NY). Figure 3a, b.

Species *M. lopezii* Hunziker affinis, sed foliis ut videtur verticillatis, floribis viridi-eburneis purpureo-maculatis, antheris inclusis, pedicellis alatis, differt.

Epiphytic liana, adhering to trunks by roots; stems coarsely pubescent with simple uniseriate trichomes ca. 0.5 mm long, giving the younger stems a warty look; older stems with papery, peeling bark. Leaves apparently verticillate in whorls of ca. 6, borne only at the tips of branches, obovate, 6–12 × 11–25 cm, pubescent on both surfaces with simple uniseriate trichomes ca. 0.5 mm long, composed of 2–4 cells, the trichomes stiffer, more yellowish and denser along the veins abaxially; major veins 4–5 pairs, drying dark brown; base attenuate; apex acute to acuminate; petiole 1–5 cm long, pubescent with stiff trichomes like those of the leaf undersides. Inflorescence an axillary raceme-like cyme, simple, length not known, apparently bearing a single flower, but with the scars of several more along its length, densely pubescent with simple, uniseriate trichomes like those of the stems. Buds not known. Flowers with the calyx lobes valvate in bud, the sutures winged onto the pedicel, divided nearly to the base at anthesis, the lobes long-triangular with an acuminate tip, densely pubescent abaxially with simple uniseriate trichomes 0.5–1 mm long, adaxially similar but also with small brownish papillate trichomes; corolla 10–11 cm long, tubular funnelform, gradually widening from the base, cream or green with lines or blotches of purple in the throat, the tube 7.5–8 cm, the lobes 5, ca. 2 × 2.5 cm, purple or violet, glabrous or with a few minute trichomes along the veins; filaments inserted ca. 1 cm from the base of the corolla tube, 2–5 cm long, glabrous at point of insertion; anthers elongate, 1.6–2.7 cm long, basifixed; style 5.5–6 cm long, glabrous except for a few simple uniseriate trichomes ca. 0.5 mm long at the very base; stigma clavate, ca. 0.8 mm long. Fruit not known.

Distribution. On the eastern slopes of the Andes in central Ecuador in premontane forest from 1000 to 1500 m (Fig. 2).

Markea epifita is clearly related to *M. lopezii* of Colombia, sharing with it the characters mentioned in the introduction in addition to the apparently elongate, possibly single-flowered inflorescence. Some of the specimens cited by Hunziker (1997) as belonging to *M. lopezii* may in fact be this taxon. The pubescence of the leaves and stems is similar, but *M. lopezii* does not have the apparently verticillate leaves of *M. epifita.* These leaves of *M. epifita* (and in all the species described here) are not strictly verticillate, but instead probably result from a concaulescence of nodes and internodes, a phenomenon very common in the Solanaceae (Danert, 1958). Exactly where the inflorescence arises in *M. epifita* is not clear, as none of the specimens I have seen has an intact inflorescence (see Fig. 2), but it is probably axillary as in the rest of the genus. It appears to be extremely long, as is the inflorescence axis of *M. lopezii.* In addition to the leaf differences, *M. epifita* differs from *M. lopezii* in its included anthers, cream or green flowers with purple blotches, and the winged pedicel apices.

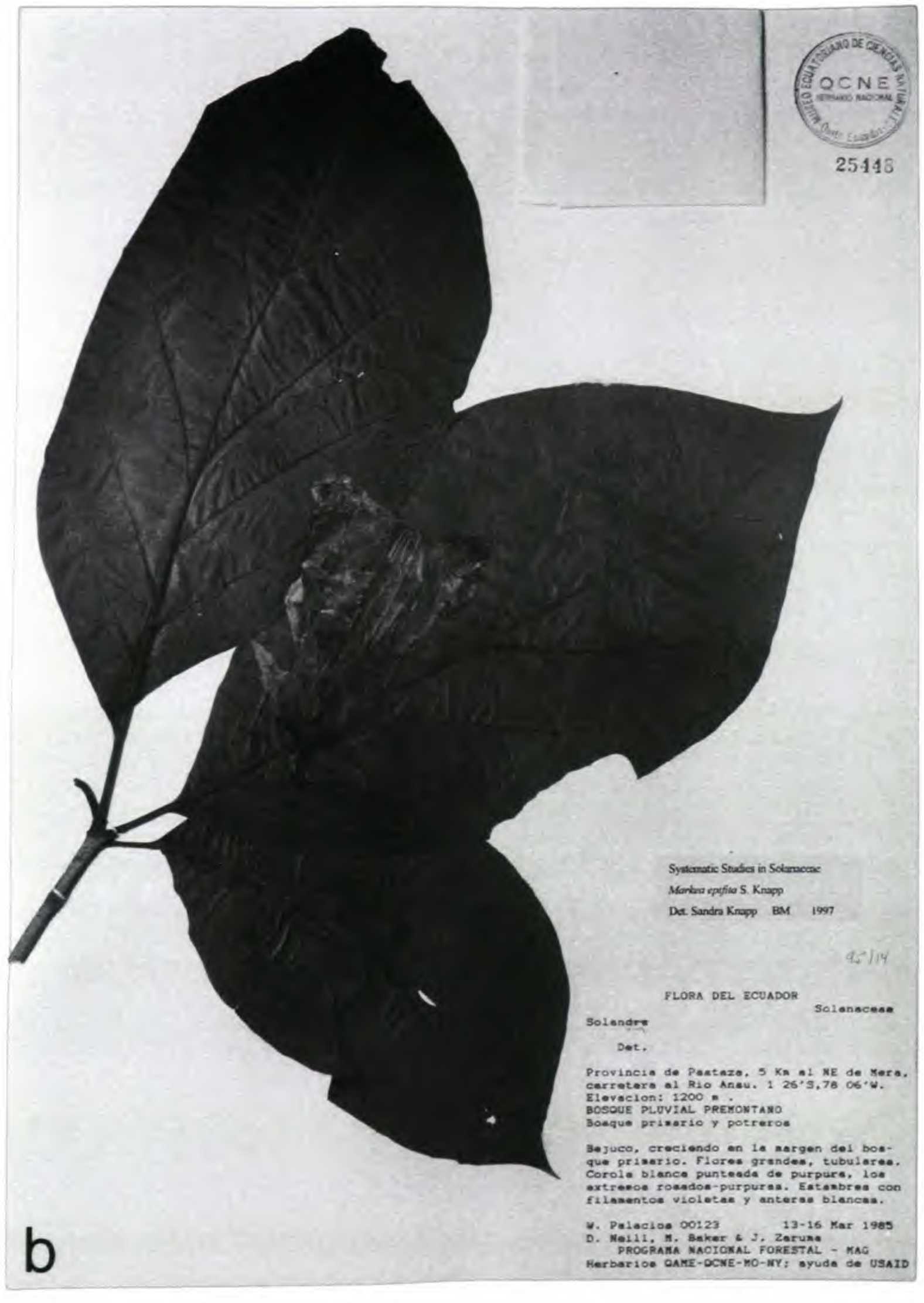


Figure 3. *Markea epifita* S. Knapp.—a. Holotype, *Cerón & Hurtado 6534* (QCNE).—b. *Palacios et al. 123* (QCNE).

The epithet, the Spanish noun meaning epiphyte, refers to the epiphytic habit of this, and all other, species of *Markea*.

Paratypes. ECUADOR. **Napo:** Canton El Chaco, Proyecto Hidroelectrico Coca, punto ST3, margen derecha del Río Quijos, ca. 10 km al S de Reventador, 1500 m, 0°11′S, 77°39′W, 3–5 Oct. 1990, *Palacios 5893* (MO, NY, QCNE); Canton Archidona, camino a Guagua Sumaco–Pacto, 1400 m, 0°44′S, 77°36′W, 25 Nov. 1992, *Palacios 10623* (QCNE). **Pastaza:** Road Veracruz (Indillana)–Canelos, 25 June 1968, *Lugo S. 75* (MO); 5 km al NE de Mera, carretera al Río Ansu, 1200 m, 1°26′S, 78°06′W, 13–16 Mar. 1985, *Palacios et al. 123* (MO, NY, QCNE); Shell, Río Pindo, 1050 m, 1°29′S, 78°04′W, 18 Aug. 1992, *Palacios 10380* (QCNE).

Markea pilosa S. Knapp, sp. nov. TYPE: Ecuador. Carchí: Canton Tulcan, Parroquia Tobar Donoso, Reserva Indigena Awá, centro El Baboso, 1800 m, 0°53′N, 78°25′W, 17–27 Aug. 1992, *Tipaz et al. 1907* (holotype, QCNE; isotype, MO not seen). Figure 4a, b.

Species *M. lopezii* Hunziker affinis, sed foliis maioribus basi truncatis vel cordatis, trichomatibus longioribus, calycis lobis magnis membranaceis, corolla rubella, differt.

Epiphytic or terrestrial shrub, to 1–2 m with adventitious roots adhering to tree trunks; stems fleshy and flexible, pubescent with uniseriate trichomes when young, later glabrescent; older stems with thin, papery bark. Leaves apparently verticillate in whorls of ca. 6, elliptic to ovate, 9–30 × 12–35 cm, densely pubescent adaxially with simple, uniseriate trichomes 1–3 mm long, composed of 4–6 cells, drying white, abaxially pubescent with simple uniseriate trichomes 1–4 mm long, composed of 4–7 cells, drying transparent and apparently stiffer than those of the adaxial surface, often deciduous on older leaves; major veins 6–7 pairs, drying yellow abaxially; base truncate to cordate; apex acute and with an elongate acumen to ca. 1 cm; petiole 2.5–6 cm long, pubescent with simple uniseriate trichomes like those of the leaves. Inflorescence an axillary raceme-like cyme, 2–5 cm long, usually bearing 4–5 flowers, the axis occasionally branched, densely pubescent with simple uniseriate trichomes 1–5 mm long, composed of 4–6 cells, each flower with 2 associated linear, stipule-like bracts 0.7–1 cm long, these densely pubescent with simple, uniseriate trichomes as the rest of the inflorescence, the bracts hidden among the trichomes of the inflorescence and soon deciduous. Buds elongate, corolla aestivation cochlear. Flowers with the calyx lobes valvate in bud, the sutures winged onto the pedicel, divided ca. ½ way to the base at anthesis, the lobes lanceolate to elliptic, 1.5–2 × 4–5(–8) cm, reddish or green, membranous and expanded with the venation prominent, densely pubescent with trichomes like those of the inflorescence axis, these densest along the margins, the tips rounded; pedicel 1–1.5 cm long, pubescent like the calyx, winged at the apex from the calyx lobe sutures; corolla 7–9 cm long, funnelform, abruptly widening ca. 1 cm from the base and then gradually widening to the lobes, slightly more expanded distally, green or reddish purple, the tube 6–8 cm, the lobes 5, 1–1.5 × 1–2 cm, rounded, externally sparsely pubescent along the veins, internally glabrous; filaments inserted ca. 1 cm from the base of the corolla tube, 2.5–3 cm long, densely pubescent at the point of insertion, otherwise glabrous; anthers elongate, 1–2 cm × 1.5 mm, basifixed; style 5–6 cm long, gradually broadening to the capitate stigma, densely pubescent along the entire length with simple uniseriate trichomes less than 0.5 mm long. Fruit not known.

Distribution. In premontane forest in northwestern Ecuador and adjacent Colombia, at (250–) 650–2200 m (Fig. 2).

Markea pilosa is a most striking plant. It has been identified as a member of the Gesneriaceae due to its occasionally shrubby habit, apparently verticillate leaves, and large, showy, fleshy flowers. It is most similar to *M. antioquiensis* of northwestern Colombia (see above), but differs from that species in its densely pubescent leaves, trichomes 1–4 mm long composed of 4–6 cells, densely pubescent style, and somewhat longer filaments. The large, membranous calyx lobes are like those of *M. antioquiensis*, but the prominent venation on the calyx of *M. pilosa* is reminiscent of the calyx of *M. longiflora* Miers of the Amazon basin (see Knapp et al., 1997 [as *M. camponoti* Ducke]).

Label data indicate that *M. pilosa* often grows as a free-standing shrub in the forest understory. However, *Palacios et al. 9808* state that when the plant is taller it is attached to trees by adventitious roots ("Arbusto hasta 80 cm de alto o hasta 2 m de largo, pero en este caso con las raices adheridas a algún tronco"). It is possible that many of the collections of *M. pilosa* are of plants that have not yet attained the epiphytic habit.

Markea pilosa clearly exhibits some polymorphism in flower color (see Fig. 3), with most collections stating that the flowers are reddish or purple (*Tipaz et al. 1907, Dodson & Gentry 17640, Méndez et al. 376, Dodson et al. 19101*), while others state that the flowers are greenish or brown ("café") (*Rubio et al. 1082, 1186, Acevedo & Daly 1676*). Flower color is noted as being "verde clara pero ligeramente violacea en la garganta por den-

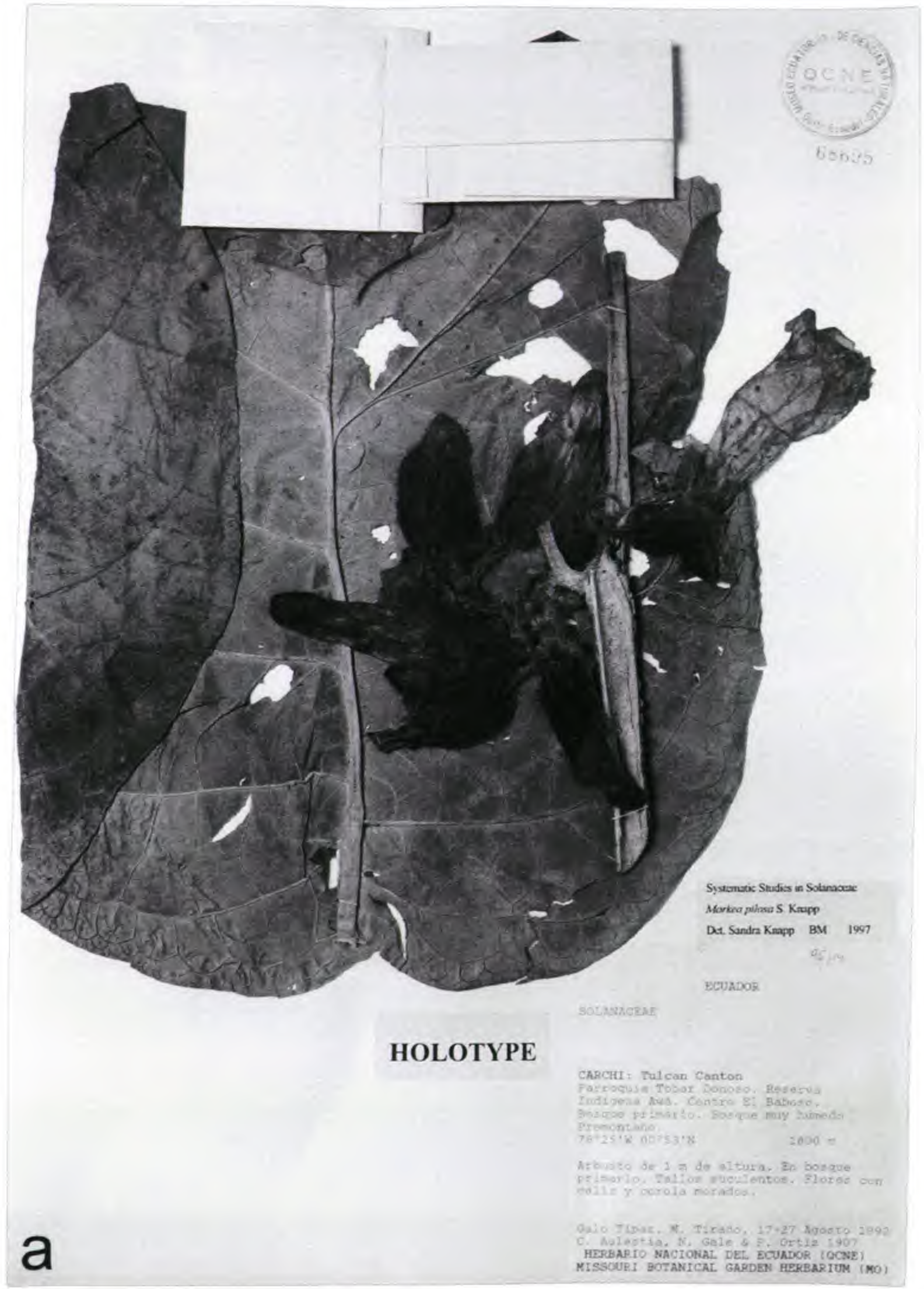


Figure 4. *Markea pilosa* S. Knapp.—a. Holotype, *Tipaz et al. 1907* (QCNE).—b. *Méndez et al. 376* (QCNE).

tro" on *Palacios et al. 9808.* Color polymorphisms are common in the Solanaceae (see Knapp & Helgason, 1997), particularly between purple and white or green.

The epithet refers to the striking dense pubescence of the leaves and inflorescences.

Paratypes. COLOMBIA. **Valle:** Vereda de Chicoral Alto, detrás de Dapa, en los nacimientos del Río Bitaco, vert. Pacifico, 2000 m, 13 Jan. 1990, *Ramos 2388* (MO). ECUADOR. **Carchi:** trail from Rafael Quindí's house to his mountain finca, 0°52′N, 78°08′W, 1890 m, 28 Nov. 1987, *Hoover & Wormley 1912* (MO); ridge to NE of Rafael Quindí's mountain finca, 2000 m, 0°52′N, 78°08′W, 29 Nov. 1987, *Hoover 2006* (MO); Reserva étnica Awá, Parroquia El Chical, Centro San Marcos, 900–1100 m, 1°06′N, 78°14′W, 20–30 Apr. 1993, *Méndez et al. 376* (QCNE); Canton Mira, N de Carmen, camino a Chical, 2000–2200 m, 0°17′N, 78°13′W, 10 Feb. 1992, *Palacios et al. 9808* (QCNE); Canton Tulcan, Parroquia Maldonado, Reserva Indígena Awá, comunidad San Marcos, 25 km al NW de El Chical, 1500 m, 1°06′N, 78°14′W, 16–30 Nov. 1990, *Rubio et al. 951* (MO), *Rubio et al. 1082* (MO, QCNE). **Esmeraldas:** Mun. de Lita, road from Lita to San Lorenzo, 10 km N of Lita, ca. 650 m, 11 May 1987, *Acevedo & Daly 1676* (NY); Cristal, km 12 Lita to Buenos Aires, off road from Lita to San Lorenzo, 1400 m, 20 July 1988, *Dodson & Gentry 17640* (QCNE); road Lita to San Lorenzo, km 18, 800 m, *Dodson et al. 19101* (QCNE).

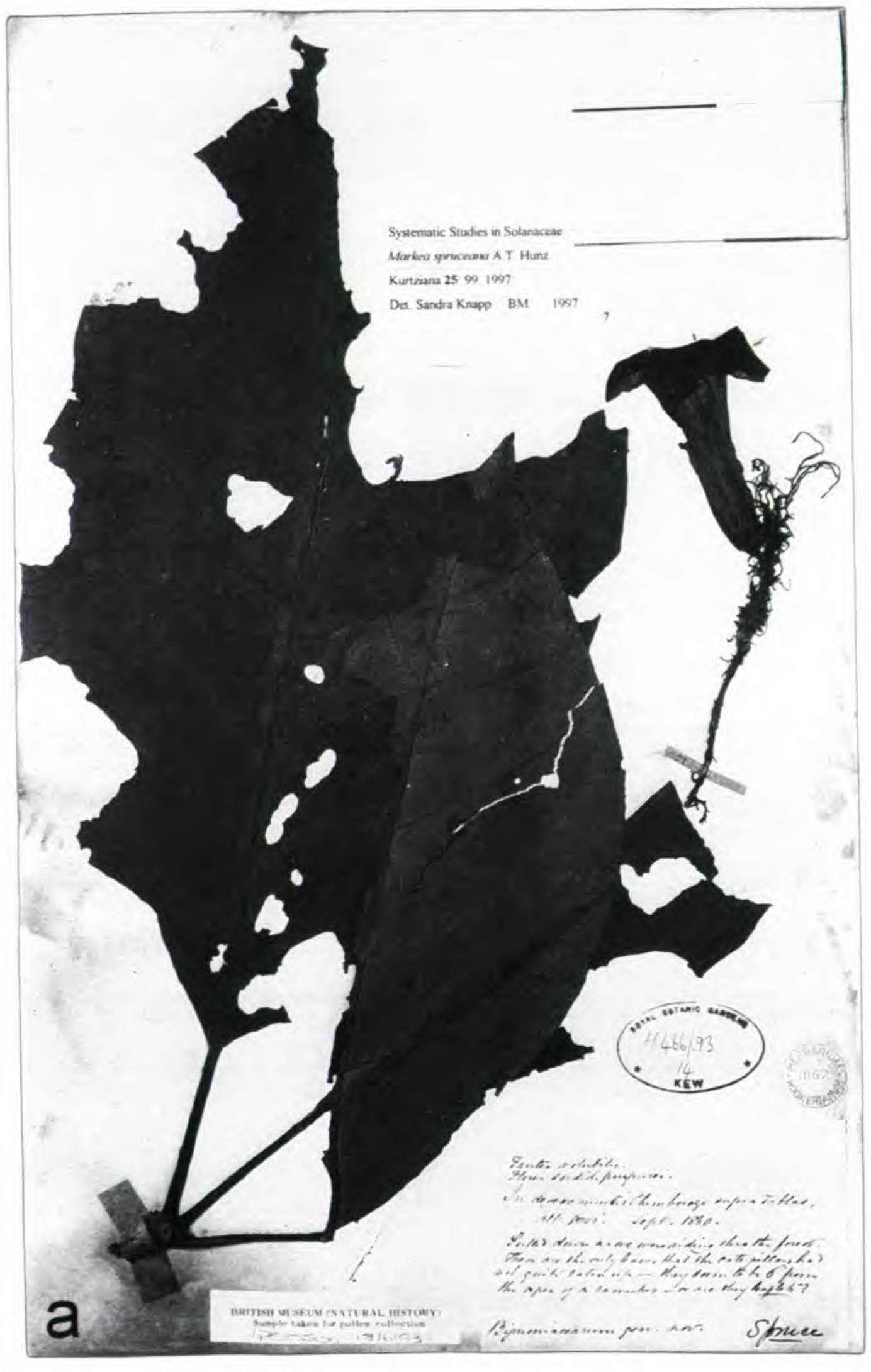
Markea spruceana Hunziker, Kurtziana 25: 99. 1997. TYPE: Ecuador. Pichincha: road Nono-Nanegal, Río Alambí, km 43–45, 2200–2500 m, 7 June 1967, *Sparre 15992* (holotype, S). Figure 5a, b.

Epiphytic shrub, branches to 3 m long; stems with the bark reddish, shiny and papery even on very young stems. Leaves apparently verticillate in whorls of 3–6, elliptic to obovate, 7–20 × 15–30 cm, glabrous on both surfaces; major veins 8–10 pairs, drying yellow; base attenuate; apex acute; petiole 2–5 cm, glabrous or with a few tiny simple uniseriate trichomes. Inflorescence an axillary raceme-like cyme, simple, 6–12 cm long, usually bearing a solitary flower, but with the scars of ca. 4 more, glabrous. Buds not known. Flowers with the calyx lobes valvate in bud, the sutures winged onto the pedicel, divided ⅓–½ way to the base at anthesis, the lobes lanceolate, membranous with prominent venation, the tips rounded, the margins ciliate or glabrous; pedicel 0.5–1 cm, glabrous or minutely pubescent with simple, uniseriate trichomes, the apex winged from the expanded calyx lobe sutures; corolla 7–12 cm long, tubular funnelform, abruptly widening ca. 1 cm from the constricted base, dark purple or greenish, the tube 6–9 cm, the lobes 5, 1–3 × 1–3 cm, glabrous except for a few simple trichomes along the veins; filaments 1.5–2 cm long, inserted ca. 1 cm from the base of the corolla tube, glabrous at point of insertion; anthers 1–1.5 cm long, basifixed, dehiscing by longitudinal slits; style 3–4 cm long, glabrous, the stigma clavate. Fruit an ellipsoid berry, green, ca. 1.2 × 2.5 cm, translucent when dry, appearing slightly winged at the apex; seeds ca. 50, ca. 3 × 2 mm, bright orange, the surfaces with deep rectangular pits, the hilum at one end.

Distribution. On the western slopes of the Andes in Ecuador, in premontane forest from 650 to 2200 m (Fig. 2).

Markea spruceana was recognized as a potentially new taxon distinct from *M. lopezii* by Hunziker (1985). I had intended to describe it as new, but the recently published study of the species of *Markea* by Hunziker (1997) makes that unnecessary. There are still very few collections of this species, and Hunziker (1997) had not seen any fruiting material when he described the species as new. *Markea spruceana* is quite similar in flower morphology to *M. pilosa*, also from the western Andean slope, but differs in its glabrous filament bases, smaller and less translucent calyx lobes, and the general lack of pubescence on the inflorescence and floral parts. The leaves of these two species are quite distinct; those of *M. pilosa* are always pubescent at least on the upper surface and are cordate or truncate at the base, while those of *M. spruceana* are glabrous and only occasionally bear a few trichomes along the veins and are attenuate at the base with the basal pair of primary veins running almost parallel to the midrib in the lower half of the leaf. The fruit, not seen by Hunziker (1997), clearly suggests that this species is a member of the genus *Markea* s. str., as the translucent berry wall and orange seeds are shared with other species of the group (see Knapp et al., 1997).

The first collection of *M. spruceana* was collected in the *Cinchona* forests of Ecuador as Spruce traveled from Guaranda to the Río Ventanas in search of plants of valuable medicinal barks for the government of British India (Spruce, 1908). In 1859, Spruce was commissioned by the British Government of the time to procure seeds and plants of the "Red bark tree" for use as anti-malarials in the tropical colonies, most notably India. Spruce spent the year 1860 working to collect this material, but once established and sent on to India the trees languished and died, probably due to the unsuitable habitat in which they were grown there (see A. R. Wallace's comments in Spruce, 1908). The label on



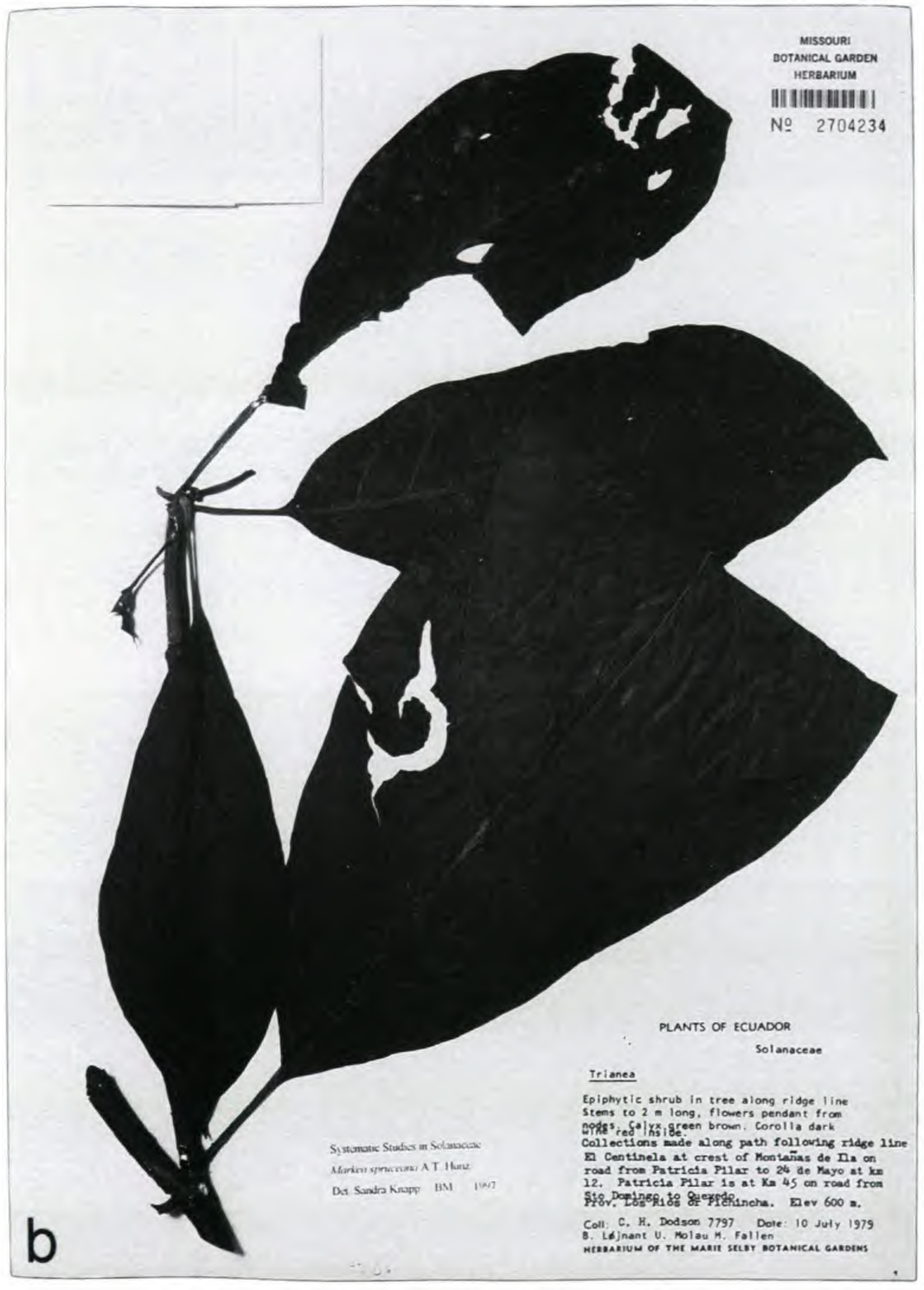


Figure 5. *Markea spruceana* Hunziker.—a. *Spruce s.n.* (K).—b. Characteristic "C"-shaped damage by larvae of ithomiine butterflies, *Dodson et al. 7797* (MO).

the specimen (see Fig. 4a) states "Pulled down as we were riding thro the forest. These are the only leaves that the caterpillars had not quite eaten up—they seem to be 6 from the apex of a ramulus—or are they *leaflets*?" The specimen was probably collected sometime between 12 and 23 September, at the end of Spruce's time in the area when he did not collect generally, as his helpers could "hardly be spared for any other service" other than preparing the *Cinchona* seedlings. I have seen no duplicates of this collection, unusual for Spruce, who normally collected in relatively large sets. Duplicates may eventually be found filed with the Bignoniaceae, as Spruce thought this plant represented a new genus in that family.

The caterpillar damage on Spruce's specimen and very evident on *Dodson et al. 7797* (Fig. 4) is characteristic of ithomiine butterflies (Lepidoptera: Nymphalidae: Ithomiinae) of the genus *Melinaea* (tribe Melinaeini). *Melinaea* and its less common relative *Olyras* are specialist feeders on epiphytic Solanaceae (Drummond & Brown, 1987) and have been reared on several genera in the solanaceous tribe Juanulloeae to which *Markea* belongs. Both *Olyras* and *Melinaea* potentially occur on the western Andean slopes in Ecuador, and either of these host-specific herbivores could be feeding on *M. sprucei*. Larvae of *Olyras* have not been collected in the wild, so their natural host plants are not definitely known.

Additional specimens examined. Sin loc.: "western slopes of the Andes, 0°–40°, 1861–1863," *Pearce s.n.* (BM). ECUADOR. **Bolívar:** "in devexo montis Chimborazo, supra Tablas, 8000′, Sept. 1860," *Spruce s.n.* (K). **Pichincha:** El Centinela at crest of Montañas de Ila on road from Patricia Pilar to 24 de mayo, km 12 (Patricia is at km 45 of Santo Domingo–Quevedo road), 600 m, 10 July 1979, *Dodson et al. 7797* (MO); Centinela, km 12 carretera Patricia Pilar–24 de Mayo, altura de km 47 Santo Domingo–Quevedo, la cima de las Montanas de Ila, 650 m, 26 July 1984, *Dodson et al. 14496* (MO, NY, QCNE); Reserva Forestal ENDESA, Río Silanche, km 113 Quito–Pto. Quito, faldas occidentales, 10 km N de la carretara principal, 0°05′N, 79°02′W, 650–700 m, 26 May 1984, *Jaramillo 6623* (MO).

Acknowledgments. I thank the curators of the herbaria cited in the text for loan of specimens in their care; David Neill and Tamara Nuñez for assistance while I collected in Ecuador; the Photographic Unit of The Natural History Museum for the figures; Viveca Persson for pollen analysis; Norman Robson for providing the Latin diagnoses; Bill D'Arcy and Gerrit Davidse for encouragement; Lynn Bohs and two anonymous reviewers for careful critique of the manuscript; and James Mallet and George Beccaloni for information about ithomiine caterpillars.

Literature Cited

Danert, S. 1958. Die Verzweigung der Solanaceen im reproduktiven Bereich. Abh. Deutsch. Akad. Wiss. Berlin 1957 (6): 1–183.

Drummond, B. A., III & K. S. Brown, Jr. 1987. Ithomiinae (Lepidoptera: Nymphalidae): Summary of known larval food plants. Ann. Missouri Bot. Gard. 74: 341–358.

Ferguson, I. K. & K. J. Pearce. 1986. Observations on the pollen morphology of the genus *Bauhinia* L. (Leguminosae: Caesalpinoideae) in the Neotropics. Pp. 283–296 *in* S. Blackmore & I. K. Ferguson (editors), Pollen & Spores: Form and Function. Academic Press, London.

Hunziker, A. T. 1979. South American Solanaceae: A synopsis. Pp. 49–85 *in* J. G. Hawkes, R. N. Lester & A. D. Skelding (editors), The Biology and Taxonomy of the Solanaceae. Academic Press, London.

———. 1985. Estudios sobre Solanaceae. XX. *Markea lopezii*, nueva especie de Colombia. Lorentzia 5: 9–12.

———. 1997. Estudios sobre Solanaceae. XLIII. Revisión de las especies de *Markea*. Kurtziana 25: 67–113.

Knapp, S. & T. Helgason. 1997. A revision of *Solanum* section *Pteroidea*: Solanaceae. Bull. Nat. Hist. Mus. London, Bot. 27: 31–73.

———, V. Persson & S. Blackmore. 1997. A phylogenetic conspectus of the Juanulloeae (Solanaceae). Ann. Missouri Bot. Gard. 84: 67–89.

Persson, V., S. Knapp & S. Blackmore. 1994. Pollen morphology and systematics of tribe Juanulloeae A. T. Hunziker (Solanaceae). Rev. Palaeobot. Palynol. 83: 1–30.

Spruce, R. 1908. Notes of a Botanist on the Amazon and Andes. Vol. II. (A. R. Wallace, editor). MacMillan, London.

A New Species of *Passiflora* (Passifloraceae) from Ecuador with Notes on the Natural History of Its Herbivore, *Heliconius* (Lepidoptera: Nymphalidae: Heliconiiti)

Sandra Knapp
Department of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD, U.K.

James Mallet
Galton Laboratory, Department of Biology, 4 Stephenson Way, University College London, London NW1 2HE, U.K.

ABSTRACT. A new species of *Passiflora*, *P. telesiphe*, is described in subgenus *Decaloba*. This species was discovered as a result of observations on the natural history and foodplants of a butterfly (*Heliconius telesiphe*—Lepidoptera: Nymphalidae: Heliconiiti), whose young stages were previously unknown. The new species and its herbivore are illustrated. The relationships of *P. telesiphe* to other similar Ecuadorean species of *Passiflora* are briefly discussed.

Passiflora telesiphe S. Knapp & Mallet, sp. nov. TYPE: Ecuador. Zamora–Chinchipe: first ford (km 10 from Zamora) on the old Loja–Zamora road, ca. 1700 m, cultivated plant grown from *Mallet 33* from this locality, 24 July 1995, *Knapp 9124* (holotype, BM; isotypes, MO, QCNE). Figures 1a–c, 2.

Species haec a *P. hirtiflora* P. M. Jørgensen & Holm-Nielsen foliis purpureis breviore et sparsiore pubescentibus, serie coronali exteriore longissime, differt.

Herbaceous vine; young stems angulate, minutely puberulent, the trichomes ca. 0.5 mm, simple and uniseriate, very slender, drying white; new growth cernuous; stipules 1.5–2.5 mm, linear and somewhat falcate, deciduous, the margins ciliate with trichomes like those of the stems; tendrils axillary, minutely puberulent. Leaves with upper surface dark green, occasionally variegated with white around the midrib, undersurface dark purple, minutely puberulent on both surfaces, hanging down as if wilted; petiole 1–1.5 cm, glandless, minutely puberulent; blade 3–8 × 5–11 cm, elliptic to elliptic lanceolate, with three main veins from the base between which are borne 14–19 ocellate glands, these somewhat pale above, the base acute, the margins entire, the apex three-lobed, each lobe terminating in an elongate mucro. New growth leaves and stems purple, changing to green when older. Flowers solitary or more often paired at each node, pendent, with no discernible odor; pedicel 2.5–3 cm, pale burgundy-purplish, minutely puberulent; bracts usually spaced ca. 1.5 mm apart in the distal ¼ of the pedicel, 7–13 × 2–5 mm, elliptic to ovate, persistent, greenish, tinged purple on live plants, drying brown, the tip long-acuminate, with a few scattered trichomes like those of the stems; buds white, minutely puberulent; sepals 2.0–2.5 cm long, narrowly triangular, membranous, pale greenish, drying white, minutely puberulent with scattered trichomes, reflexed at anthesis; petals 1.0–1.4 cm, narrowly triangular, thin and membranous, white, glabrous, reflexed at anthesis; corona biseriate, the outer filaments 2.2–2.6 cm, narrowly ligulate, white flushed with purple, especially adaxially in the lower ⅓, the inner filaments 3–5 mm, erect, greenish white, purple flecked near the tips, the extreme tips somewhat fimbriate, expanded and white; operculum plicate, incurved, ca. 4 mm, greenish, purple near the tips; limen annular, 1–1.5 mm high, bright yellow-green; androgynophore 6–8 mm, dark purplish burgundy; free stamen filaments 4–5 mm, the anthers 3–4 mm, pollen bright yellow; ovary 3–4 mm long, pale burgundy purple, densely pubescent with uniseriate trichomes less than 0.5 mm long, the styles ca. 5 mm, dark burgundy purple (like the androgynophore), the stigmas globose, bright green. Fruit unknown.

Passiflora telesiphe is a member of subgenus *Decaloba* (DC.) Reichenbach, with a plicate operculum, ocellate laminar nectaries, and cernuous new growth. It is likely a member of section *Pseudogranadilla* (Harms) Killip, where its close relatives are *P. hirtiflora* P. M. Jørgensen & Holm-Nielsen, *P. subpurpurea* P. M. Jørgensen & Holm-Nielsen, and perhaps *P. indecora* HBK, all of which are Ecuadorian endemics. All of these species are unusual in *Passiflora* in having foliaceous, verticillate

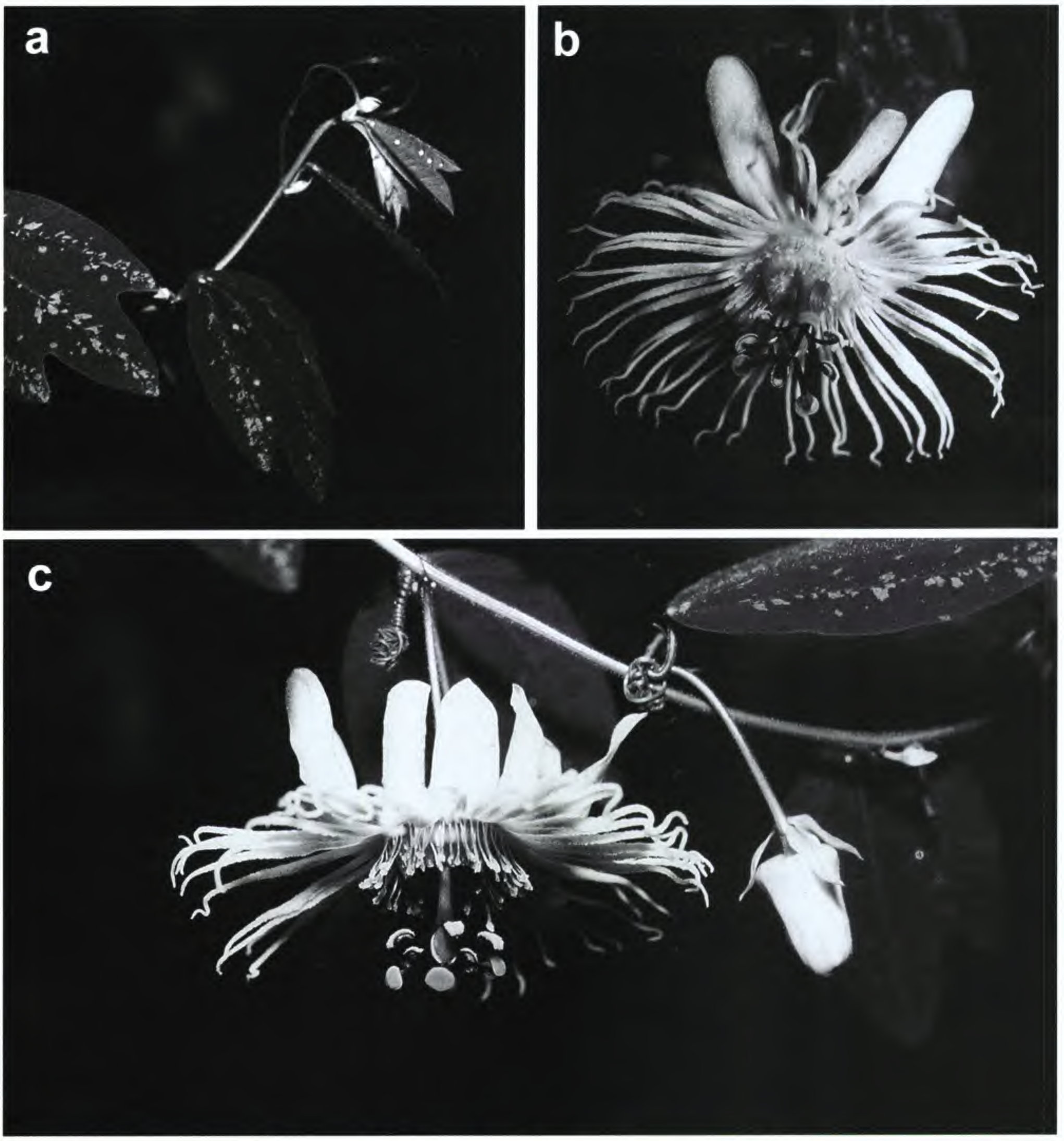
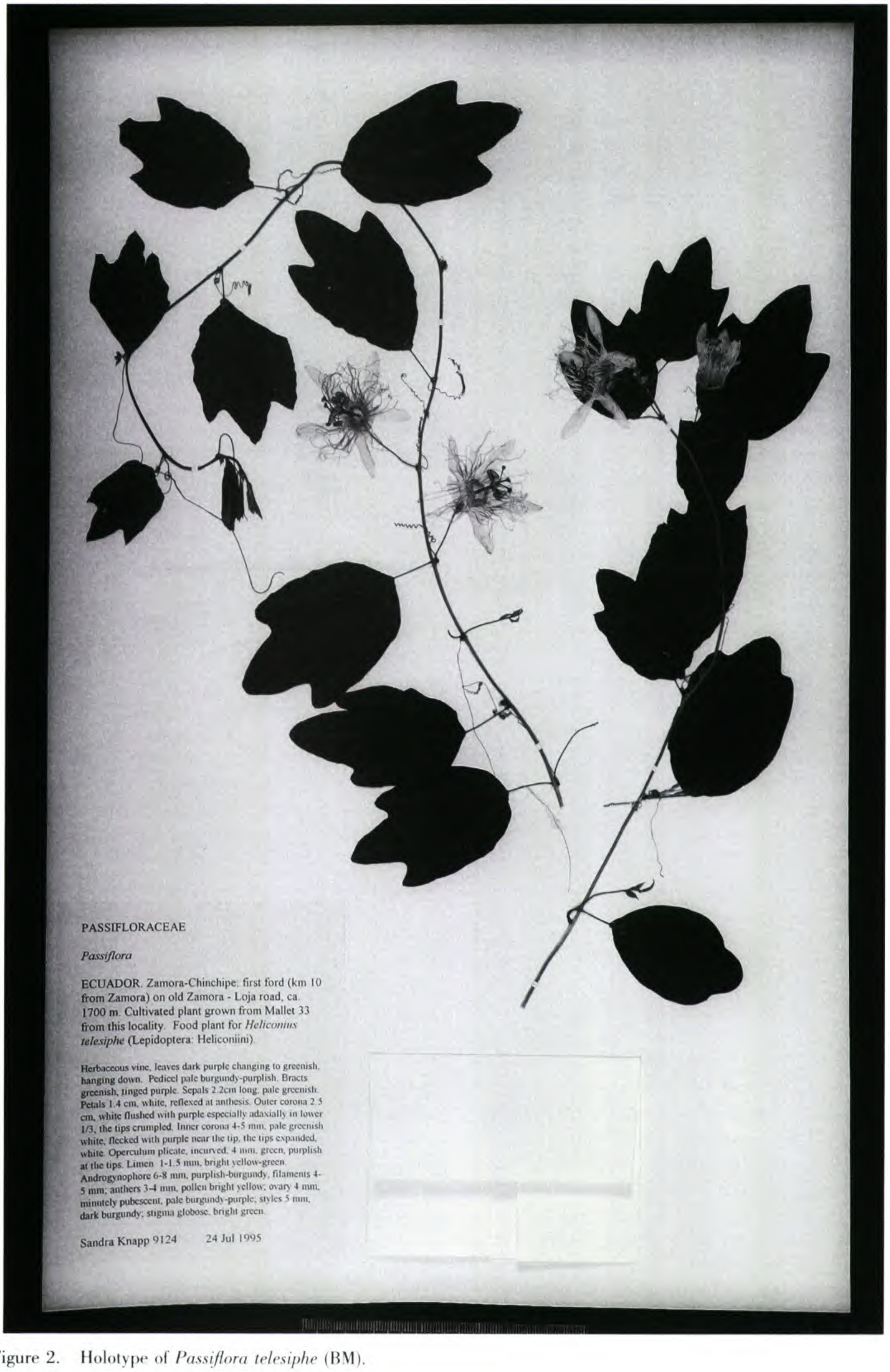


Figure 1. *Passiflora telesiphe* S. Knapp & Mallet (*Knapp 9124*, cultivated).—a. Fertile shoot showing characteristic new growth and leaf position.—b. Flower, close-up showing coronal rows.—c. Flower and bud.

bracts near the base of the flowers. Section *Pseudogranadilla* (sensu Killip, 1938) is apparently not monophyletic, but the Ecuadorian species seem to be closely related and may form a distinct clade within the group.

The sister species of *Passiflora telesiphe* is most probably *P. hirtiflora*. *Passiflora hirtiflora* and *P. telesiphe* share the peculiar habit, otherwise unknown in the genus, of having the leaves hanging down, apparently wilting, at all times (see Fig. 1). Plants in cultivation (MO: *P. hirtiflora* fide J. MacDougal and in the United Kingdom: *P. telesiphe*) are very similar in appearance at first glance, but differ in their degree of pubescence, with *P. hirtiflora* being much more pubescent and with longer trichomes (1–3 mm vs. ca. 0.5 mm). The two species also share falcate stipules that dry brownish, and large floral bracts. The flowers of *P. telesiphe* are strikingly different from those of *P. hirtiflora*, with the outer row of corona filaments being longer than the petals and sepals (Fig. 1), while the outer corona row in *P. hirtiflora* is only ca. ½ or less the length of the sepals (ca. 1–1.2 cm long) and is much less delicate. *Passiflora telesiphe* is also similar to *P. subpurpurea* in that its leaves are purple abaxially but differs from *P. subpurpurea* in its overall pubescence and long corona filaments. Also potentially included in this group of Ecuadorean species with large floral bracts is *P. indecora*, which differs from *P. telesiphe* in its bilobed leaves,



PASSIFLORACEAE

Passiflora

ECUADOR. Zamora-Chinchipe: first ford (km 10 from Zamora) on old Zamora - Loja road, ca. 1700 m. Cultivated plant grown from Mallet 33 from this locality. Food plant for *Heliconius telesiphe* (Lepidoptera: Heliconiini).

Herbaceous vine, leaves dark purple changing to greenish, hanging down. Pedicel pale burgundy-purplish. Bracts greenish, tinged purple. Sepals 2.2cm long, pale greenish. Petals 1.4 cm, white, reflexed at anthesis. Outer corona 2.5 cm, white flushed with purple especially adaxially in lower 1/3, the tips crumpled. Inner corona 4-5 mm, pale greenish white, flecked with purple near the tip, the tips expanded, white. Operculum plicate, incurved, 4 mm, green, purplish at the tips. Limen 1-1.5 mm, bright yellow-green. Androgynophore 6-8 mm, purplish-burgundy, filaments 4-5 mm; anthers 3-4 mm, pollen bright yellow; ovary 4 mm, minutely pubescent, pale burgundy-purple; styles 5 mm, dark burgundy; stigma globose, bright green.

Sandra Knapp 9124 24 Jul 1995

Figure 2. Holotype of *Passiflora telesiphe* (BM).

smaller flowers, and very short (4–5 mm) outer coronal row.

Paratypes. ECUADOR. **Zamora–Chinchipe:** first ford above Zamora (km 10, Zamora–Loja) on the old Loja–Zamora road, ca. 1700 m, 21 Nov. 1993, *Mallet 33* (BM, MO).

Passiflora telesiphe was discovered with the aid of a butterfly. On 21 Nov. 1993, a male of *Heliconius telesiphe telesiphe* (Lepidoptera: Nymphalidae: Heliconiiti) was seen hovering at a pupa of *Heliconius* attached to the plant of *Passiflora telesiphe* (*Mallet 33*) from which all other specimens cited here are clones. The pupa showed no obvious differences from that of *Heliconius erato* (Beebe et al., 1960). After several minutes, another male *H. telesiphe* arrived and hovered closely at the pupa. The pupa was kept, and later eclosed as a female *Heliconius telesiphe.* We found a number of yellow eggs on the same plant; when reared through, these also proved to be *H. telesiphe.* In the last instar, the creamy white black-spotted larvae (Fig. 3a, b) were typical for the *erato* group and similar to *Heliconius erato* or *H. charitonia* in that they had paired facial black spots on the front of the head (these facial spots were smaller than in either of the latter species). As far as we know, this is the first record of the young stages of *Heliconius telesiphe*, which, although a relatively common Andean butterfly in its narrow band of altitudes between 800 m and 2000 m from southern Colombia to Bolivia, has a poorly known biology. The young stages will be described in detail by Carla Penz (pers. comm. 1996), who reared eggs and larvae of *H. telesiphe telesiphe* she found on an unidentified bilobed leaf species of subgenus *Plectostemma* (cf. *P. indecora*, also sect. *Pseudogranadilla*) in Prov. Napo, near Baeza at 1400 m alt., in Nov. 1992. The adult of *H. telesiphe* is mimicked by *Podotricha telesiphe* (Lepidoptera: Nymphalidae: Heliconiiti), which, like *H. telesiphe*, has a yellow hindwing band in the north of its range, and a white hindwing band from 3°S southward (Vane-Wright et al., 1975).

It is clear that careful observation of natural history in the field can not only lead to new biological and behavioral data, but also to the discovery of new taxa. In our case, collaborative work has benefited both our specialities. Knowledge of tropical organisms can be greatly increased if botanists observe and record animal behavior on and around plants and if entomologists (and other zoologists) carefully collect vouchers, even if sterile, of plant specimens.

Acknowledgments. We thank Chris Jiggins for help with fieldwork; Peter Jørgensen for excellent

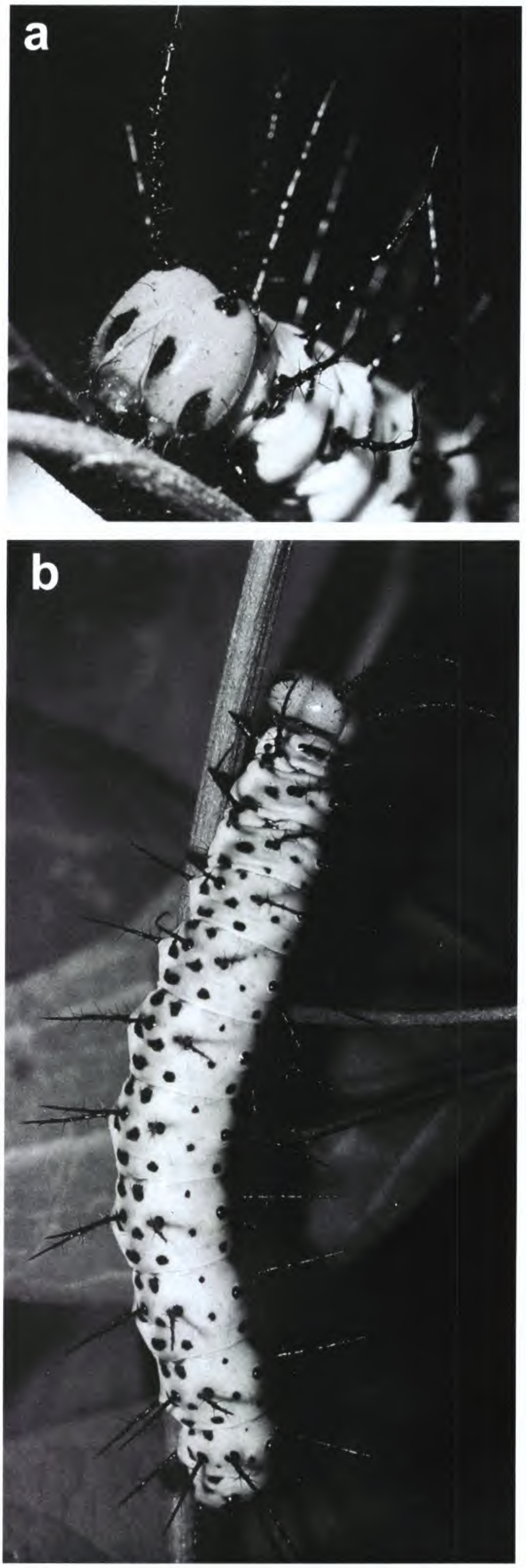


Figure 3. Larva of *Heliconius telesiphe.*—a. Detail of fifth instar larval head.—b. Fifth instar larva.

advice; John MacDougal for the same and for carefully reviewing the manuscript; Carla Penz for personal communications about *Heliconius telesiphe*; INEFAN for permits and Germania Estevez and Miguel Moreno for sponsorship to study the fauna and flora of Ecuador; N. K. B. Robson for the Latin diagnosis; R. Duffell for preparing the holotype; P. L. V. Mallet and M. G. T. Shone for growing plants of *P. telesiphe*, and BBSRC for supporting the research on *Heliconius* in Ecuador.

Literature Cited

Beebe, W., J. Crane & H. Fleming. 1960. A comparison of eggs, larvae and pupae in fourteen species of Heliconiine butterflies from Trinidad, W.I. Zoologica, N.Y. 45: 111–153.

Killip, E. P. 1938. The American species of Passifloraceae. Publ. Field Mus. Nat. Hist., Bot. Ser. 19: 3–613.

Vane-Wright, R. I., P. R. Ackery & R. L. Smiles. 1975. The distribution, polymorphism and mimicry of *Heliconius telesiphe* (Doubleday) and the species of *Podotricha* Michener (Lepidoptera: Heliconiinae). Trans. Roy. Entomol. Soc. Lond. 126(4): 611–636.

New Taxa and Nomenclatural Notes on the Flora of the Marojejy Massif, Madagascar—I. Capparaceae: A New Species of *Crateva*

James S. Miller
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. A new species of *Crateva* L. is described from the Marojejy Massif in northeast Madagascar. It differs from previously described species in having simple obovate leaves with a rounded apex. The species is deciduous and flowers soon after the leaves emerge, indicating that it is a member of section *Siccoruba* Jacobs.

The Marojejy Massif is an isolated upland area in northeastern Madagascar in the province of Antsiranana. Located between Andapa, to the west, and Sambava, to the east, the massif rises out of undulating lowlands to a vast upland area mostly above 800 m to its highest point at 2137 m, Marojejy Est. It is bounded by the valleys of the Androranga River on the north and the Lokoho River on the south. Marojejy is the easternmost of the satellite upland regions that surround Tsaratanana, which lies approximately 100 km to the northwest and at 2876 m is the center of the northern highlands. The upland areas that occur in closest proximity to Marojejy include Betsomanga (ca. 1250 m) ca. 25 km to the north, Andramanalana (2260 m) 40 km to the west, and Forêt D'Anjanaharibe (ca. 1850 m) ca. 40 km to the southwest. A large number of endemic taxa have been reported from Marojejy (Humbert, 1955), but it is unclear what percentage of these also occur on the scattered peaks between Marojejy and Tsaratanana, as most remain very poorly explored.

The central portion of the massif and some of the surrounding lowland areas comprise a 50,000-ha protected area, the Réserve Intégrale No. 12, which was established 31 December 1927. The massif consists mostly of uplifted gneiss, and the topography is extremely rugged with numerous peaks in the reserve above 1500 m. Marojejy and the Forêt d'Anjanaharibe comprise most of the watershed for the Andapa region, one of Madagascar's most important rice-producing areas. Prevailing winds come from the southeast, and the northern portion of the reserve is somewhat drier than the southern and eastern flanks of the massif.

The lowland portions of the reserve consist of a mosaic of evergreen tropical forest, with a canopy 30–60 m tall and secondary growth in areas of cyclone disturbance dominated by *Afromomum angustifolium* K. Schumann and several species of bamboo. The steep slopes of the central massif between 500 and 1000 m are also mostly forested, except for exposed areas of gneiss and the most extreme slopes. Above 1000 m, a variety of vegetation types occur, depending on slope, exposure, and depth of soil. More sheltered valleys are covered with wet, medium-height forest (the *sylve à lichens* of Humbert, 1955), whereas wind-swept ridges below about 1700 m have a dense cover of shrubs and occasional trees to 5 m. The uppermost reaches of the numerous peaks have an open, primarily herbaceous vegetation with numerous Cyperaceae, Poaceae, and Orchidaceae and scattered patches of shrubs up to about a meter tall primarily composed of Rubiaceae, Ericaceae, and *Symphonia microphylla* (Cambessèdes) Bentham & Hooker ex Vesque (Clusiaceae).

Henri Humbert collected intensively in the area from 1948 to 1950, discovering many new taxa and clearly demonstrating that the massif is a center of endemism within northeastern Madagascar (Humbert, 1955). However, Humbert's published accounts of his collecting were not comprehensive, and the author began a new effort to inventory the region thoroughly with four collecting trips in 1988 and 1989. Since that time intensive collecting has continued, and the results will be summarized in a checklist of the Marojejy Massif (Miller, Rakotomalaza, Raharilala, and Rakotondrainibe, in prep.). These recent efforts have yielded many new discoveries that will be named in this series, although a species of *Ardisia* Swartz (Myrsinaceae) has been previously published based on these collections (Miller & Pipoly, 1993).

The genus *Crateva* L. (see Gómez, 1953, for notes on the correct orthography of the generic name) consists of eight species widely distributed in the tropics (Jacobs, 1964), with three reported from Madagascar. Although Hadj Moustapha (1965) recognized four species, Jacobs (1964) pointed out that *Crateva humblotii* (Baillon) Hadj-Moustapha was a confused name probably based on *Capparis humblottii* Baillon and specimens referable to *C. excelsa* Bojer and *C. obov-*

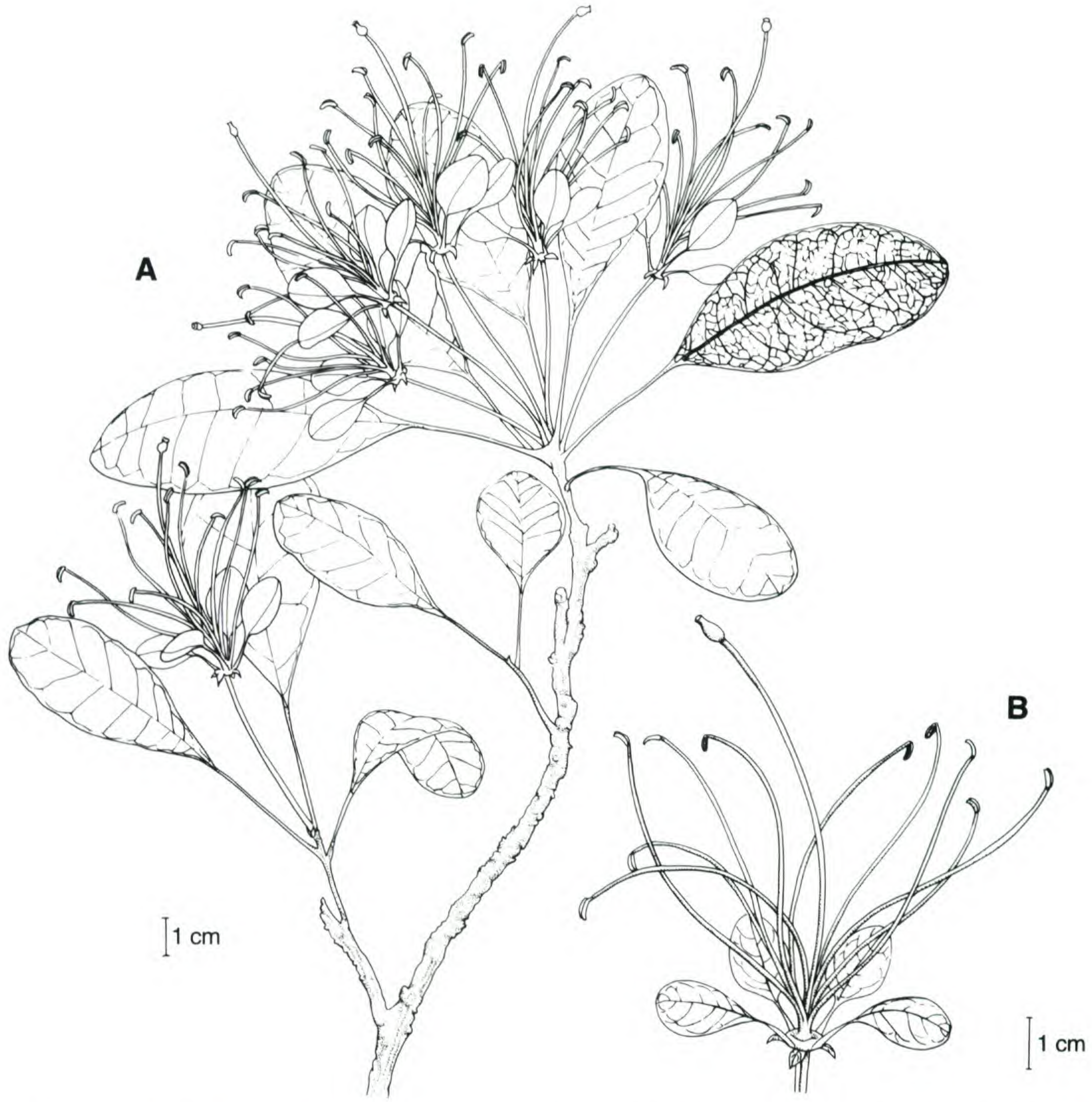


Figure 1. *Crateva simplicifolia* J. S. Miller.—A. Flowering branch with emerging leaves.—B. Flower. (Both from *Rasoavimbahoaka 381*, MO.)

ata Vahl. *Crateva simplicifolia* is known only from the type collection and is the only species of *Crateva* that lacks compound leaves. The one known collection indicates that flowers are produced as the new leaves emerge, which would place it in *Crateva* sect. *Siccoruba* Jacobs, along with the other Malagasy species. It is possible that leaves of the type collection are not fully expanded.

Crateva simplicifolia J. S. Miller, sp. nov. TYPE: Madagascar. Antsiranana: Sambava, Andrahanjo, Antongodriha, Réserve Naturelle Intégrale de Marojejy, aux environs de la rivière Antsahatsimidy, 720–800 m, 14°20′S, 49°43′E, *F. Rasoavimbahoaka 381* (holotype, MO 5056508; isotypes, K, P, TAN, US, WIS). Figure 1.

Frutex ad 6 m altus; a congeneris foliis simplicibus differt.

Shrub to 6 m tall, the twigs glabrous, unevenly ridged lengthwise, the ridges becoming somewhat corky. Leaves deciduous, unifoliolate; blades membranous, narrowly obovate, 3.7–10.2 cm long, 2–4.7 cm wide, the apex rounded to obtuse, the base acute to cuneate, attenuate to the petiole without any pulvinus or petiolule, the margin entire, both surfaces glabrous, the venation brochidodromous, the midrib distinct, more so beneath, the secondary veins 4–7; petioles 2.4–5 cm long, slender, glabrous. Flowers borne on ca. 2-cm-long peduncles of the current season's growth in terminal clusters of 2–7 intermixed with 2–3 leaves, the pedicels

Table 1. A comparison of the morphological features of *Crateva simplicifolia* and *C. obovata*.

	C. simplicifolia	*C. obovata*
Leaves	simple	3–foliolate
Lamina length	3.7–10.2 cm	4–7 cm
Lamina width	2–4.7 cm	2–3.5 cm
Petiole length	2.4–5 cm	1.2–4.2(–8) cm
Inflorescences	2–7-flowered	24–36-flowered
Receptacle width	5–7 mm	3–4.5 mm
Petal length	18–23 mm	12–19 mm
Petal width	9–14 mm	7–11 mm
Claw length	7–11 mm	4–8 mm

4.4–6.5 cm long, glabrous; floral receptacle bowl-shaped with a swollen upper rim, 5–7 mm wide, with sepals and petals arising from the exterior surface; sepals 4, lanceolate, 3–5 mm long, ca. 1 mm wide, glabrous; petals 4, red, drying with a reddish tint, slightly unequal in length, the lamina elliptic, 18–23 mm long, 9–14 mm wide, the apex rounded, the base cuneate, attenuate to the 7–11-mm-long slender claw; stamens 8–11, connate at the base into a column ca. 2 mm long, the filaments 4.5–8.5 cm long, the anthers curved, 2.5–3 mm long; gynophore 4.8–8.2 cm long, the ovary ellipsoid, 1.5–2 mm long, 1–1.2 mm wide, topped by a capitate stigma. Fruit unknown.

Crateva simplicifolia is distinct in its simple leaves, the largest of which exceed measurements reported by Jacobs (1964) for *C. obovata*, the only other species with a rounded leaf apex and the one with which it is most likely to be confused. It differs further in having flower parts larger than those of *C. obovata* and many fewer flowers per inflorescence (Table 1). Jacobs (1964) also reported that the inflorescence of *C. obovata* was truly terminal and did not continue elongating later, and the presence of occasional leaves in the inflorescences of *C. simplicifolia* may indicate that its branches do elongate through the inflorescence and continue growing after flowering.

Acknowledgments. Fieldwork at Marojejy was funded by the National Geographic Society (3647-87), the World Wildlife Fund-U.S., and the World Wide Fund for Nature (project #6502). Financial support for the parataxonomists program, which supported the collector of this new species, was provided by the Liz Claiborne/Art Ortenberg and John D. and Catherine T. MacArthur Foundations. Theodore Cochrane and Hugh Iltis (WIS) and Lars Kers (SBT) provided valuable review comments. I thank Barbara Alongi for the illustration and Roy E. Gereau for comments on the manuscript and Latin description.

Literature Cited

Gómez, S. A. 1953. Caparidáceas Argentinas. Lilloa 26: 279–341.

Hadj Moustapha H., S. E. M. 1965. Capparidacées. Fl. Madagasc. 83: 1–71.

Humbert, H. 1955. Une merveille de la nature à Madagascar. Première exploration botanique du massif du Marojejy et de ses satellites. Mém. Inst. Sci. Madagascar, Sér. B, Biol. Veg. 6: 1–210.

Jacobs, M. 1964. The genus *Crataeva* (Capparaceae). Blumea 12: 177–208.

Miller, J. S. & J. J. Pipoly III. 1993. A new species of *Ardisia* (Myrsinaceae) from Madagascar. Novon 3: 63–65.

New Taxa and Nomenclatural Notes on the Flora of the Marojejy Massif, Madagascar—II. Anacardiaceae: A New Species of *Campnosperma*

James S. Miller and Armand Randrianasolo
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. A new species of the genus *Campnosperma*, previously considered to contain only a single species in Madagascar, is described from the Massif de Marojejy in northeastern Madagascar. *Campnosperma parvifolium* differs from *C. micranteium* in its smaller leaves, with fewer secondary veins, and sparsely but evenly lepidote leaf undersurface. It occurs on high mountain ridges at Marojejy and Anjanaharibe, while *C. micranteium* is a species found on sand in littoral forests.

The Massif de Marojejy in northeast Madagascar, in the province of Antsiranana, has always been of great interest botanically (Humbert, 1955), but recent intensive collecting has yielded a variety of new species (Miller, 1998; Miller & Pipoly, 1993). *Campnosperma*, a genus of Anacardiaceae with perhaps a dozen species in tropical America, Madagascar, the Seychelles, tropical Asia, and the western Pacific, has been previously considered to consist of only a single species in Madagascar, *Campnosperma micranteium* L. March (Perrier de la Bâthie, 1946). The species are trees having leaves with lepidote scales, unisexual flowers with twice as many stamens as petals, and a 2-celled drupe. René Capuron had reviewed the herbarium material from Madagascar in the herbarium of the Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle (P) and annotated the specimens, recognizing several infraspecific taxa, but his results were never published. Examination of the presently available collections of *Campnosperma* indicates that the variation presented is much too significant to be accounted for by a single species (Miller & Randrianasolo, in prep.). One population that is particularly distinct is the following new species.

Campnosperma parvifolium R. Capuron ex J. S. Miller & A. Randrianasolo, sp. nov. TYPE: Madagascar. Antsiranana: Réserve Naturelle Marojejy, along the trail to the summit of Marojejy Est, below the third camp, lichen forest and exposed wind-swept ridges, elev. 1100–1300 m, 14°26′S, 49°15′E, 10 Oct. 1988, *James S. Miller et al. 3529* (holotype, MO 5067322; isotypes, G, K, NY, P, TAN, TEF, US). Figure 1.

Arbor parva vel frutex, 2(10–12) m alta. Folia persistentia, coriacea; lamina elliptica ad obovata (1.4–)2–6.7 cm longa, (0.9–)1.5–3.3 cm lata, apice retusa ad rotundata, basi obtusa ad cuneata, pagina inferiore glabra vel sparsim stellata, lepidota. Inflorescentiae racemosae ad paniculatae, (1–)3.3–6.3 cm longae. Flores unisexuales, gemmae 1 mm longae. Fructus drupaceus, ellipsoideus, 7–9 mm longus, 5–7 mm latis, glabratus.

Small tree or shrub 2(10–12) m tall, the young twigs densely covered with a mixture of lepidote scales and stellate hairs, later glabrescent and smooth or somewhat waxy. The leaves persistent, coriaceous; blades elliptic to obovate, (1.4–)2–6.7 cm long, (0.9–)1.5–3.3 cm wide, the apex retuse to rounded, the base obtuse to cuneate, sometimes briefly decurrent along the petiole for ca. 1–2 mm, the margin strongly revolute, entire, the adaxial surface glabrous, waxy, and lustrous, sometimes sparsely lepidote, the abaxial surface glabrous or occasionally with sparse stellate hairs, evenly lepidote (appearing gland-dotted), but the scales not overlapping, the venation brochidodromous, prominent, and raised on both surfaces, the secondary veins 5–9, parallel, often only slightly more prominent than the dense reticulum of tertiary veins on the lower surface; petioles 3–8 mm long, stout, canaliculate on the adaxial surface, lepidote to densely stellate-pubescent. Inflorescences borne in the upper leaf axils, sparsely branched panicles or racemes (1–)3.3–6.3 cm long, the branches evenly to densely lepidote to stellate, each flower subtended by a triangular bract 0.5–1 mm long. Flowers unisexual, the plants functionally dioecious, with reduced anthers in female flowers and reduced ovaries in male flowers, small, 1 mm long in bud, 3–4 mm diam. when open, on pedicels 0.5–1.5 mm long, ca. 1 mm diam.; sepals 4, imbricate, deltate, ca. 0.5 mm long, lepidote; petals 4, imbricate, broadly elliptic, 1–2 mm long, ca. 1 mm wide, glabrous or with an occasional lepidote scale on the exterior surface; stamens 8, the filaments inserted at the base of the disc, flattened and broader at the base, ca. 0.5 mm long, the anthers ca. 0.2 mm long; nectariferous disc annular and unevenly lobed; ovary ovoid, small, and partially immersed in the an-

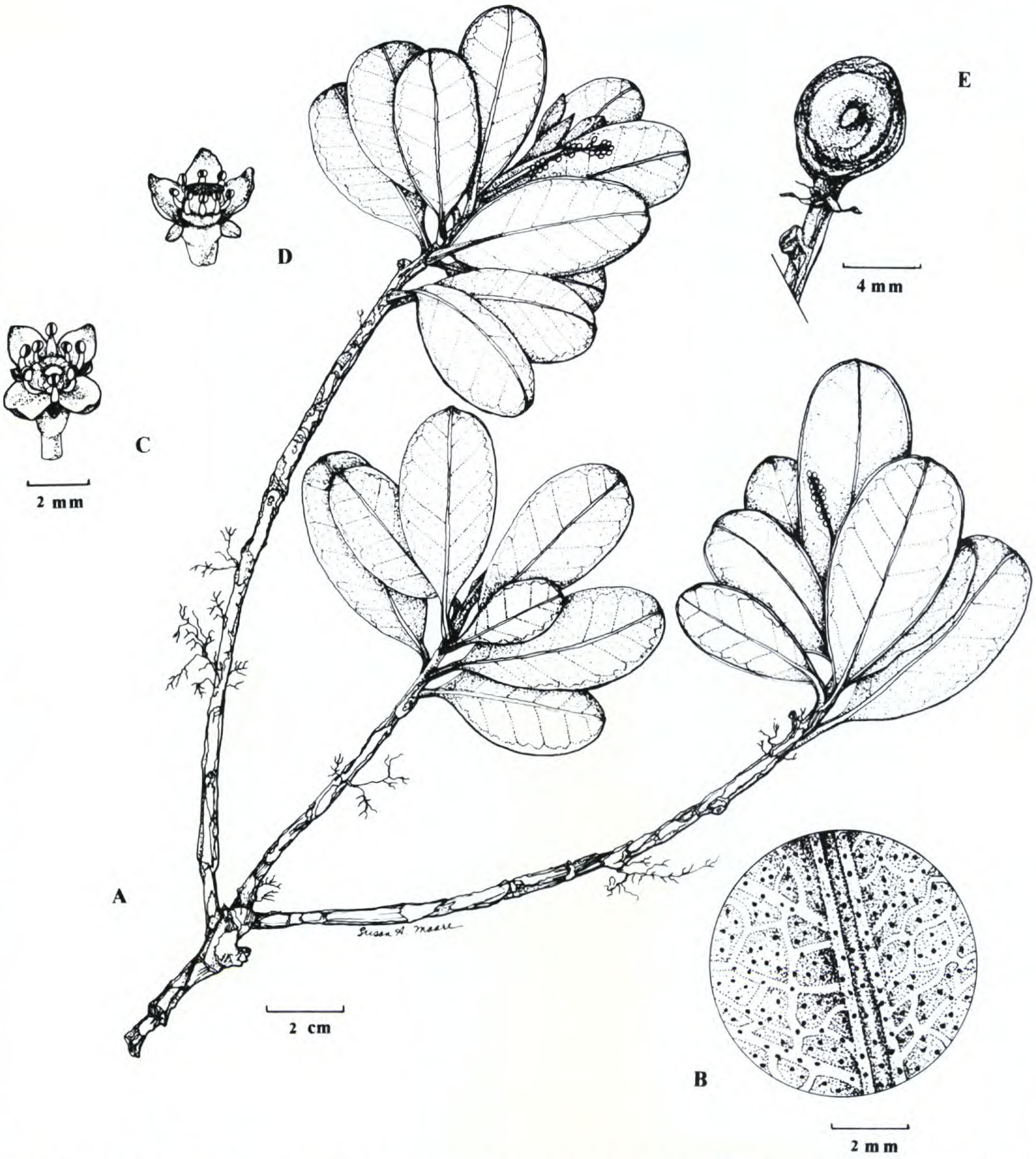


Figure 1. *Campnosperma parvifolium* R. Capuron ex J. S. Miller & A. Randrianasolo.—A. Flowering branch with fruticose lichens along stems.—B. Lower leaf surface with lepidote scales.—C. Male flower.—D. Female flower.—E. Fruit. A, B, C, and E from *Miller et al. 3529.* D from *SF 936.*

nular disc, the stigma subdiscoidal. Fruit drupaceous, broadly ellipsoid, 7–9 mm long, 5–7 mm broad, glabrous.

Campnosperma parvifolium is known only from upland parts of the massifs of Marojejy and Anjanaharibe Sud, where it occurs from 700 to 1600 m. It is a common tree or shrub of the short forests that occur along wind-swept ridges, and the branches are often covered with lichens.

This distinctive species is characterized by leaves that are always less than 7 cm long, generally much smaller than those found in any of the other Malagasy populations of *Campnosperma*, less than nine secondary veins, and a lower leaf surface with evenly spaced, very small lepidote scales, giving rise to a glandular appearance. The flowers are also only about 1 mm in diameter, much smaller than those of *C. micranteium* and other Malagasy populations of *Campnosperma.* René Capuron had begun a study of the genus and had annotated some

of the specimens in the herbarium of the Laboratoire de Phanérogamie in Paris (P), but he never published on the group. A study currently under way (Miller & Randrianasolo, in prep.) will provide a modern revision of the Malagasy species, but this name is published in advance to make it available for a checklist of the flora of the Marojejy massif (Miller et al., in prep.).

Paratypes. MADAGASCAR. **Antsiranana:** Rive gauche de la Manantenina, versant sud du Beondroka, 1040 m, 14°25′S, 49°50′E, *Deroin & Badré 40* (MO, P); Massif de l'Anjanaharibe (pentes et Sommet Nord) a l'ouest d'Andapa, sylve à lichens, 1600–1800 m, *Humbert et al. 24783* (P); Réserve Naturelle de Marojejy, western slopes and summit of Mt. Beondroka, lichen forest and open wind-swept ridges, 830–1210 m, 14°27′S, 49°47′E, *Miller & Randrianasolo 4473* (MO, TAN); Réserve Naturelle de Marojejy; western slopes of Mt. Beondroka, cloud forest and open, wind-swept ridges, 750–900 m, 14°27′S, 49°47′E, *Miller & Randrianasolo 4487* (MO, P, TAN); Reserve Naturelle de Marojejy, along the trail to the summit of Marojejy Est, N of Mandena, premontane forest, lichen forest, and exposed wind-swept ridges below the 3rd camp, 900–1300 m, 14°26′S, 49°46′E, *Miller & Randrianasolo 4683* (MO, P, TAN); Reserve Naturelle Intégrale de Marojejy, 10.5 km NW of Manantenina, along tributary at head of Andranomifotra River, Campement 4, 1625 m, 14°26′24″S, 49°44′30″E, *Rakotomalaza et al. 871* (MO, P); Massif de l'Anjanaharibe (W d'Andapa), 1600 m, *SF 936* (P—2 sheets).

The name *Campnosperma* was originally published as neuter by Thwaites (1854), and this has been followed by recent authors (Hou, 1978). However, the name was treated incorrectly as feminine in the *Flore de Madagascar et des Comores* (Perrier de la Bâthie, 1946), so *Campnosperma micranteia* is corrected to conform orthographically as *C. micranteium.*

Acknowledgments. Fieldwork at Marojejy was funded by the National Geographic Society (3647-87), the World Wildlife Fund—U.S., and the World Wide Fund for Nature (project #6502). We thank Susan A. Moore for the illustration and Roy E. Gereau for assistance with the Latin description. Helpful review comments were received from Michel Hoff (P) and John D. Mitchell (NY), who provided useful information on the gender of the name *Campnosperma.*

Literature Cited

Hou, D. 1978. Anacardiaceae. Flora Malesiana 1(8): 395–548.

Humbert, H. 1955. Une merveille de la nature à Madagascar. Première exploration botanique du massif du Marojejy et de ses satellites. Mém. Inst. Sci. Madagascar 6: 1–210.

Miller, J. S. 1997. New taxa and nomenclatural notes on the Flora of the Marojejy Massif, Madagascar—I. Capparaceae: A New Species of *Crateva.* Novon 8: 167–169.

——— & J. J. Pipoly III. 1993. A new species of *Ardisia* (Myrsinaceae) from Madagascar. Novon 3: 63–65.

Perrier de la Bâthie, H. 1946. Anacardiacées. Flore de Madagascar et des Comores. 114: 1–85.

Thwaites, G. H. K. 1854. Description of some new genera and species of Ceylon plants. Hooker's J. Bot. Kew Gard. Misc. 6: 65–72.

Chaptalia hermogenis (Asteraceae: Mutisieae), a New Species from the Brazilian Atlantic Rain Forest

Marta Dias de Moraes
Departamento de Botânica, I.B., UNICAMP, Caixa Postal 6109,
Campinas 13083-970, SP, Brazil

ABSTRACT. *Chaptalia hermogenis* (sect. *Archichaptalia)*, currently known only from a montane forest in the Atlantic Rain Forest region of southeastern Brazil, is described and illustrated. The new species is compared with the closely similar *C. cordifolia* (Baker) Cabrera. It is distinguished by a long involucre, the long expanded limb with an inner linear lip of the female florets, the absence of tubular-filiform internal female florets, a character rare in the genus, and a sparsely pubescent achene.

Chaptalia Ventenat comprises about 56 species distributed from the southern United States to southern South America (Nesom, 1995), with at least 12 species occurring in Brazil. Some Brazilian species have a wide distribution, while a few seem to be endemic to smaller areas, such as *C. denticulata* (Baker) Zardini in the Atlantic Rain Forest of the state of Rio de Janeiro and *C. graminifolia* (Dusén) Cabrera in the states of Paraná and Santa Catarina. The most useful taxonomic treatment of this genus is still the monograph by Burkart (1944). His seven sections were considered by Nesom (1995) to be probably natural. A group of species that Burkart (1944) referred to *Trichocline* Cassini, although he found the species difficult to separate from *Chaptalia* sect. *Archichaptalia* Burkart, has since then been transferred to *Chaptalia. Trichocline cordifolia* Baker, transferred to *Chaptalia* by Cabrera (Cabrera & Klein, 1973), closely resembles the new species described here. *Trichocline*, distributed in South America, and *Gerbera* L., in Africa and Asia, are generally accepted as closely related to *Chaptalia*, but both differ from this genus by the presence of staminodes in the female florets, a difference accepted by Burkart (1944) but considered as not completely satisfactory. Hansen (1990) concluded from his phylogenetic studies in the *Gerbera*-complex (*Chaptalia, Trichocline, Gerbera,* and four small genera (*Leibnitzia* Cassini, *Lulia* Zardini, *Perdicium* L., and *Uechtritzia* Freyn)), that this complex should be ranked as a single, large genus, but considered it premature to propose any formal taxonomic changes. The cladogram presented by Hansen (1990) is based only on 15 characters and some of these are polymorphic in his terminal taxa. For example, the character "scape" was considered bracteate in the genus *Chaptalia*, but the scape in the new species is ebracteate as it is in several *Chaptalia* species (e.g., *C. integerrima* (Vellozo) Burkart, *C. nutans* (L.) Polák). *Chaptalia hermogenis* is included in section *Archichaptalia* based on its long-petiolate leaves and shortly decurrent, broadly ovate blades. The inclusion of the new species enlarges the circumscription of section *Archichaptalia*, because *C. hermogenis* has the corolla of the inner female florets longer than the style. The new species has an ebracteate scape, while *C. cordifolia* has a scape without or with few linear bracts. In the other species of this section the scape is described as bracteate with few to many bracts, and as in *C. cordifolia*, the corolla of the inner female florets is described as being shorter than the style.

Chaptalia hermogenis M. D. Moraes, sp. nov. TYPE: Brazil. São Paulo: Eldorado, Núcleo Caverna do Diabo, Parque Estadual de Jacupiranga, on nearest hill on the E side of the headquarters, 24°38′41″S, 48°23′31″W, ca. 600 m alt., 5 Sep. 1996. *M. D. Moraes & F. A. R. D. P. Arzolla 367* (holotype, UEC; isotypes, B, F, G, K, LP, M, MBM, MO, NY, R, RB, SP, UPS, W). Figure 1.

Chaptalia hermogenis C. cordifoliam (Baker) Cabrera simulat, sed differt scapo florifero semper ebracteato, ferrugineo-villoso praecipue ad apicem; capitulo multifloro; involucro 15.7–21 mm longo; floribus marginalibus 16–30 femininеis ligulato-bilabiatis exsertis, limbo 11.5–13.6 mm longo, 2–2.6 mm lato, 4–6-nervato, apice integro vel tridentato, lobulo interno 2-laciniato, 1.7–7.3 mm longo, rare integro; floribus femininеis internis 11–43 floribus marginalibus similibus sed centrum versus minoribus; flosculis femineis reductis nullis; floribus centralibus disci 24–61 masculis, corollis bilabiatis 9.2–10.5 mm longis, limbo 3-denticulato, lobulis reflexis apice papilloso; acheniis pubescentibus.

Perennial herb up to 20 cm high with a rosette

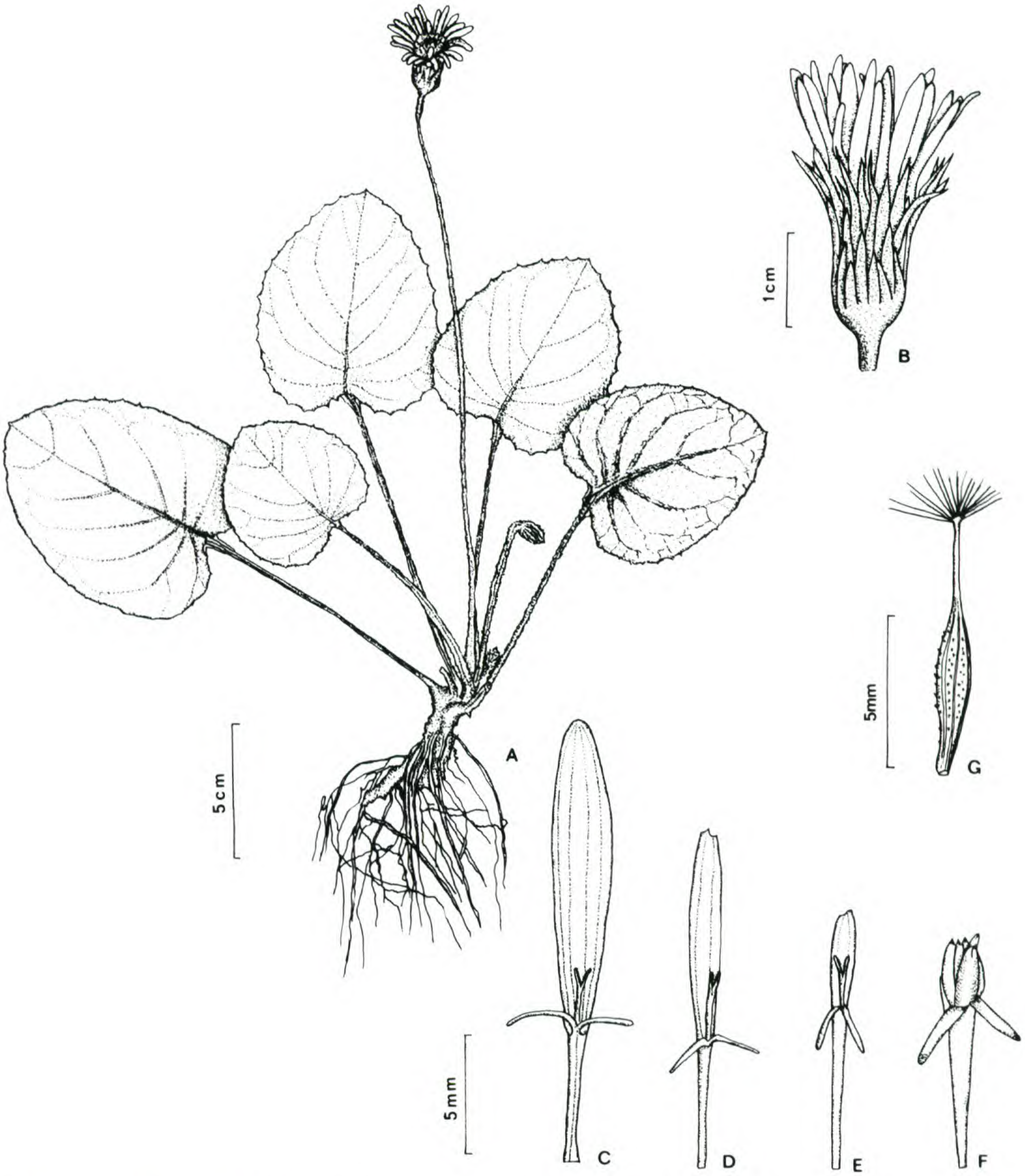


Figure 1. *Chaptalia hermogenis* M. D. Moraes.—A. Habit.—B. Capitulum showing the involucre.—C. Corolla of the outer female florets.—D, E. Corolla of the inner female florets decreasing in size toward the center.—F. Corolla of the central functionally male florets.—G. Achene with pappus base. Based on type specimen *M. D. Moraes & F. A. R. D. P. Arzolla 367* (UEC).

of basal leaves. Petiole 5.5–24 cm long, golden brown villous-tomentose; blade (3–)5–9(–12) × (3.5–)5–9(–11) cm, broadly to very broadly ovate, base cordate, shortly decurrent, apex obtuse or rounded, with minute apiculus, margin sparsely minutely denticulate; blade with 4–7 veins per side, anastomosing, impressed above, prominent below, upper surface initially sparsely villous, becoming glabrous with remains of the indumentum on the basal portion of the midvein, lower surface densely pale golden brown villous-tomentose. Scape (12–) 16–35(–42) cm long, 1.3–2.2 mm diam., ebracteate, golden brown villous, particularly at the apex; head nodding in bud, erect at anthesis; involucre 15.7–21 mm long, campanulate; involucral bracts in 3–4 rows, densely golden brown villous. Florets

white, outer female florets 16–30, liguliform-bilabiate, tube 4.5–5.7 mm long, limb long-exserted, 11.5–13.6 × 2–2.6 mm, 4–6-veined, apex entire or slightly 1–3-denticulate, inner lip linear, 1.7–7.3 mm long, deeply or rarely shallowly cleft in two equal or unequal segments or entire; inner female florets 11–43, bilabiate, in one or several rows with corolla decreasing in size toward the center, basal tube 4.6–6.6 mm long, limb 3–10 × 0.6–1.6 mm, 2–4-veined, apex entire or slightly 1–3-denticulate, inner lip linear, 1–2.8 mm long, deeply cleft in equal or unequal segments; inner tubular-filiform female florets lacking; styles of female florets 7.4–9 mm long, stigmatic branches 0.5–1.4 mm long; central functionally male florets 24–61, tubular-bilabiate, corolla 9.2–10.5 mm long, outer lobe slightly recurved, 3-denticulate, inner lobe recurved, deeply cleft, tips of all lobes papillate; style ± of the same length as the corolla, stigmatic branches ca. 0.7 mm long. Achene 7–10.4 mm long including a rostrum of 2.2–4.5 mm, 5–8-ribbed, sparsely pubescent with short trichomes rounded at the apex. Pappus bristles 6.8–8.7 mm long.

Chaptalia hermogenis is known only from the type locality in a montane forest in the Atlantic Rain Forest region of southeastern Brazil, state of São Paulo, characterized by limestone outcrops and by shrubs or small trees with the genera *Clethra*, *Clusia*, *Eugenia*, and *Rapanea* predominating. It grows on steep slopes near the summits of hills at an altitude of ca. 600 m, in rather scattered populations in partial shade, on litter accumulation or on a thin layer of soil over weathered limestone. Flowering is from July to September. *Chaptalia cordifolia* (Baker) Cabrera closely resembles the new species and also occurs in the Atlantic Rain Forest, but the soil conditions are unknown. *Chaptalia cordifolia* seems to have a disjunct distribution in Rio de Janeiro and Santa Catarina states. It has never been collected in the states of São Paulo and Paraná. *Chaptalia hermogenis* has an ebracteate scape, while *C. cordifolia* has a scape without or with a few linear bracts. The involucre in *C. hermogenis* reaches twice the length of that of *C. cordifolia*, and the limbs of its outer female florets are more than twice the length of those of *C. cordifolia*; furthermore, its limbs have an inner lip, while the limbs in *C. cordifolia* do not. *Chaptalia cordifolia* has internal tubular-filiform female florets and the achenes are glabrous, whereas in *C. hermogenis* this kind of floret is completely absent, and the achenes are sparsely pubescent.

The new species is dedicated to the late Hermógenes de Freitas Leitão Filho (1944–1996), an expert in Asteraceae and enthusiastic botanist of the Brazilian flora. I am grateful for his early encouragement of my work.

Paratype. BRAZIL. **São Paulo:** Eldorado, Núcleo Caverna do Diabo, Parque Estadual de Jacupiranga, 24°38′S, 48°23′W, 14 July 1995, *M. D. Moraes 66* (UEC).

Acknowledgments. I am grateful to V. Bittrich for a careful review of the manuscript and several suggestions. I thank G. J. Shepherd, who reviewed the manuscript for English grammar, and J. Semir, F. Vitta, and R. R. Rodrigues for helpful comments. I specially thank G. M. Barroso, for her encouragement and for the Latin diagnosis. I also thank the three reviewers, G. Harling, H. V. Hansen, and M. O. Dillon, for several valuable comments and corrections.

Literature Cited

Burkart, A. 1944. Estudio del género de Compuestas *Chaptalia* con especial referencia a las especies argentinas. Darwiniana 6: 505–594.

Cabrera, A. L. & R. M. Klein. 1973. Compostas. Tribo Mutisieae. Pp. 1–124 *in* P. R. Reitz, Flora Ilustrada Catarinense ed. I. (Fasc. Comp.). Itajaí, Brazil.

Hansen, H. V. 1990. Phylogenetic studies in the *Gerbera*-complex (Compositae, tribe Mutiseae, subtribe Mutisiinae). Nordic J. Bot. 9: 469–485.

Nesom, G. L. 1995. Revision of *Chaptalia* (Asteraceae: Mutisieae) from North America and continental Central America. Phytologia 78: 153–188.

Two New Orders for Monocotyledonous Plants

James L. Reveal
Department of Plant Biology, University of Maryland, College Park, Maryland 20742-5815, U.S.A.

Wendy B. Zomlefer
University of Florida Herbarium (FLAS), 379 Dickinson Hall, P.O. Box 110575, University of Florida, Gainesville, Florida 32611-0575, U.S.A.

ABSTRACT. Two new orders, Tofieldiales and Nartheciales, are proposed for two phylogenetically isolated groups of monocotyledonous families, Tofieldiaceae and Nartheciaceae, long associated with a polyphyletic Melanthiales. Tofieldiales is better considered a member of the Alismatidae, being tentatively considered a member of the Alismatanae and the sister group of Alismatales (s.l.). Nartheciales remains a member of the Liliidae, forming a basal group within Lilianae.

Recent work on the genera of monocotyledonous plants for the Generic Flora of the Southeastern United States by Zomlefer (1996, 1997a, b, c) has demonstrated the need for a series of nomenclatural modifications that more accurately reflect the results of ongoing phylogenetic studies. With Melanthiaceae being shown to be polyphyletic (e.g., Chase et al., 1993, 1995a, b), adoption of Tofieldiaceae Takhtajan and Nartheciaceae Fries ex Bjurzon is a logical conclusion. Their placement within the monocots is still somewhat problematic, with the molecular and morphological evidence presented by the above cited authors suggesting that Tofieldiaceae should be considered the sister group of a broadly defined Alismatales (in the Alismatanae, Alismatidae). Nartheciaceae, however, should remain associated with the Lilianae (in Liliidae) as a basal member of that superorder. What is not problematic is that both families belong to their own order, neither of which is currently published. Accordingly, the following two names are proposed.

Tofieldiales Reveal & Zomlefer, ord. nov. Based on a full and direct reference to the Latin description associated with a C. S. Kunth (Enum. Pl. 4: 165. 17–19 July 1843, as sect. Tolfieldieae, nom. inval.: Art. 33.5) name.

Nartheciales Reveal & Zomlefer, ord. nov. Based on a full and direct reference to the Latin description associated with a F. Parlatore (Fl. Ital. 2: 360. 1852, as tribe Narthecieae) name.

As here circumscribed, Tofieldiales is defined to include Tofieldiaceae, which is composed of *Harperocallis* McDaniel (1, Florida), *Isidrogalvia* Ruiz & Pavon (5, northern South America), and *Tofieldia* Hudson (15–17, Northern Hemisphere and Andes of South America; including *Pleea* Michaux). Nartheciales is defined to include only Nartheciaceae, a family of four genera: *Aletris* L. (15, eastern Asia and North America; including *Metanarthecium* Maximowicz), *Lophiola* Ker Gawler (2, eastern North America), *Narthecium* Hudson (7, Northern Hemisphere), and *Nietneria* Klotzsch ex Bentham (1, Guyana and Venezuela). Japonoliriaceae Takhtajan, which is restricted to the rare Japanese endemic *Japonolirion* Nakai (1, Japan), requires more work to assess its status and position.

Acknowledgment. This work is supported in part by the Maryland Agricultural Experiment Station and Cooperative Extension Service. This proposal originated during work by the second author on the Generic Flora of the Southeastern United States, a long-term project funded by the National Science Foundation, currently supported by DEB-9419940 (Walter S. Judd, principal investigator) and DEB-9419952 (Norton G. Miller, principal investigator). We thank Walter S. Judd for helpful comments on the phylogeny of the polyphyletic melanthioid complex.

Literature Cited

Chase, M. W., M. R. Duvall, H. G. Hills, J. G. Conran, A. V. Cox, L. E. Eguiarte, J. Hartwell, M. F. Fay, L. R. Caddick, K. M. Cameron & S. Hoot. 1995a. Molecular phylogenetics of Lilianae. Pp. 109–137 *in* P. J. Rudall, P. J. Cribb, D. F. Cutler & C. J. Humphries (editors), Monocotyledons: Systematics and Evolution. Royal Botanic Gardens, Kew.

———, D. W. Stevenson, P. Wilkin & P. J. Rudall. 1995b. Monocot systematics: A combined analysis. Pp. 685–730 *in* P. J. Rudall, P. J. Cribb, D. F. Cutler & C. J. Humphries (editors), Monocotyledons: Systematics and Evolution. Royal Botanic Gardens, Kew.

———, D. E. Soltis, R. G. Olmstead, D. Morgan, D. H. Les, B. D. Mishler, M. R. Duvall, R. A. Price, H. G. Hills, Y.-L. Qui, K. A. Kron, J. H. Rettig, E. Conti, J. D. Palmer, J. R. Manhart, K. J. Sytsma, H. J. Michaels, W. J. Kress, K. G. Karol, W. D. Clark, M. Hedrén, B. S. Gaut, R. K. Jansen, K.-J. Kim, C. F. Wimpee, J. F. Smith, G. R. Furnier, S. H. Strauss, Q.-Y. Xiang, G. M. Plunkett, P. S. Soltis, S. M. Swensen, S. E. Williams, P. A. Gadek, C. J. Quinn, L. E. Eguiarte, E. Goldenberg, G. H. Learn, Jr., S. W. Graham, S. C. H. Barrett, S. Dayanandan & V. A. Albert. 1993. Phylogenetics of seed plants: An analysis of nucleotide sequences from the plastid gene *rbc*L. Ann. Missouri Bot. Gard. 80: 528–580.

Zomlefer, W. B. 1996. The Trilliaceae in the southeastern United States. Harvard Pap. Bot. 1(9): 91–120.

———. 1997a. The genera of Melanthiaceae in the southeastern United States. Harvard Pap. Bot. 2: 133–177.

———. 1997b. The genera of Tofieldiaceae in the southeastern United States. Harvard Pap. Bot. 2: 179–194.

———. 1997c. The genera of Nartheciaceae in the southeastern United States. Harvard Pap. Bot. 2: 195–211.

The Tribal Position of *Hypocalyptus* Thunberg (Fabaceae)

Anne Lise Schutte and B.-E. van Wyk*

Department of Botany, Rand Afrikaans University, P.O. Box 524, 2006 Auckland Park, Johannesburg, South Africa. *Present address: Compton Herbarium, National Botanical Institute, Kirstenbosch, Private Bag X7, 7735 Claremont, South Africa

ABSTRACT. The tribal position of *Hypocalyptus* Thunberg in the Fabaceae subfamily Papilionoideae is investigated. A phylogenetic analysis in which the Australian Bossiaeeae and Mirbelieae, African Podalyrieae and Crotalarieae, South American Sophoreae and Millettieae, and northern temperate Thermopsideae and Genisteae are included, indicates that there is no direct relationship between *Hypocalyptus* and any of the tribes. It is therefore proposed that the monotypic subtribe Hypocalyptinae Yakovlev be raised to tribal level as Hypocalypteae (Yakovlev) A. L. Schutte. A description of the tribe is presented, followed by an enumeration of the three species recognized.

Hypocalyptus Thunberg is a genus of papilionoid legumes confined to the Cape Floristic Region of South Africa. The genus is easily recognized by its trifoliolate leaves, magenta-pink flowers with a yellow nectar guide, intrusive calyx base, and fused stamens. It comprises three distinct species, which are restricted to the fynbos vegetation of the Western and Eastern Cape Provinces (Dahlgren, 1972).

Despite its well-defined generic circumscription, the tribal affinities of *Hypocalyptus* have been uncertain ever since Bentham's (1837, 1839) fundamental classification of the subfamily was published. This is clearly reflected in the number of times the genus has been transferred from one tribe or subtribe to another. Bentham (1837, 1839, 1844) placed the genus in the tribe Loteae subtribe Genistinae, which he later changed to the tribe Genisteae subtribe Cytisinae (Bentham, 1865). Harvey (1862) retained the genus in the Genisteae, recognizing no subtribes. In 1964 Hutchinson raised the Cytisinae to tribal level and allocated *Hypocalyptus* to the Cytiseae. Polhill (1976, 1981f) transferred the genus to the tribe Liparieae, which Yakovlev (1991) subdivided into the subtribes Lipariinae and Hypocalyptinae. He placed *Hypocalyptus* in the monotypic Hypocalyptinae. The problem regarding the tribal position of *Hypocalyptus* is thus quite evident. This has, in fact, also been pointed out by several authors (Dahlgren, 1972; Polhill, 1976, 1981e, 1994; Goldblatt, 1981; Bell et al., 1978; Van Wyk et al., 1994; Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).

As part of a taxonomic study of the tribes Podalyrieae and Liparieae, Schutte (1995) investigated the position of *Hypocalyptus* within the tribes. Morphological, anatomical, cytological, and chemical characters were examined and analyzed cladistically to determine inter- and infratribal relationships. The results clearly indicated that *Hypocalyptus* is misplaced in the Liparieae and should be excluded, while the Podalyrieae and remainder of the Liparieae are monophyletic and should be united (Schutte, 1995; Schutte & Van Wyk, 1997).

Hypocalyptus deviates from the Podalyrieae (including the Liparieae) in no less than nine critical characters (Table 1). Of particular interest are the micromorphological characters, i.e., floral pigmentation (Van Wyk et al., 1994); the accumulation of canavanine in the seed (Bell et al., 1978); a chromosome base number of $x = 10$ (Goldblatt, 1981; Van Wyk & Schutte, 1995); and ephemeral antipodals in the female gametophyte (Schutte, 1997). These, in addition to the five macromorphological characters of the stamens, seed, and pods, indicate unambiguously that *Hypocalyptus* does not fit in the Podalyrieae.

The aim of this paper is to examine the phylogenetic position of *Hypocalyptus* within the subfamily Papilionoideae. To this end we scanned the literature and selected all the tribes which are assumed to, or have previously been suggested to, be possibly related to the genus. Based on these criteria, the Australian Bossiaeeae and Mirbelieae, African Podalyrieae and Crotalarieae, northern temperate Genisteae and Thermopsideae, and South American Sophoreae and Millettieae were chosen as outgroups (see, e.g., Dahlgren, 1972; Polhill, 1976, 1981a, 1981g, 1994; Crisp & Weston, 1987). It is important to note that the primary objective of this study is to establish whether *Hypocalyptus* is directly related to any of the tribes, and not to analyze the relationships among the different tribes.

Table 1. Taxonomic differences between *Hypocalyptus* and the tribe Podalyrieae.

Character	Podalyrieae	*Hypocalyptus*
1. Stamen fusion	free to open sheath	closed tube
2. Seed aril shape	interrupted at the micropylar end	continuous around the hilum
3. Micropyle type	punctate	y-shaped
4. Micropyle position	within hilar region	outside hilar region
5. Pods	sessile	stipitate
6. Chromosome base number	$x = 9$	$x = 10$
7. Antipodals	persistent	ephemeral
8. Floral pigments	esters of cyanidin-3-glucoside	malvidin-3-glucoside
9. Canavanine	absent	present

Analysis and Results

The data matrix, characters, and character states used for the tribal analysis are given in Table 2. These have largely been taken from Van Wyk and Schutte (1995), with some additions and alterations, e.g., the inclusion of *Hypocalyptus* as a separate taxonomic unit, the incorporation of the Millettieae and the omission of the *Argyrolobium* group (now included in the Genisteae; Van Wyk & Schutte, 1995). Data for the Australian Bossiaeeae and Mirbelieae came mainly from Polhill (1976, 1981c, 1981d) and Crisp and Weston (1987, 1995). Information on the Millettieae and Sophoreae has been taken from Geesink (1981) and Polhill (1981b), respectively. Polhill (1976) and Bisby (1981) were consulted for information on the Genisteae, and Turner (1981) for data on the Thermopsideae. Variation in the characters and polarization of character states are discussed in the references given at the end of each character. Where plesiomorphic and apomorphic states co-occur, the taxon was scored for the plesiomorphic state. Autapomorphies for the taxa were excluded from the analyses, since they serve no purpose as grouping characters.

The computer software package Hennig 86 (Farris, 1988) was used for the cladistic analysis and the "mhennig*", "bb*", and "ie" algorithms were applied to produce cladograms of minimal length. A single, fully resolved topology resulted from the analysis, with a length of 24, a consistency index of 66, and a retention index of 71 (Fig. 1). The result shows that *Hypocalyptus* has no direct relationship with the Podalyrieae, the Australian tribes, or the Millettieae and Sophoreae.

Discussion

Hypocalyptus remains a perplexity as far as its taxonomic position is concerned. It has a unique combination of characters, but the individual characters are shared with a wide range of different tribes. The intrusive calyx is shared with the Podalyrieae; the closed stamen tube is shared with the Millettieae and Genisteae; a fleshy aril is present also in the Podalyrieae, Bossiaeeae, Mirbelieae, and some Millettieae; a Y-shaped micropyle situated outside the hilum occurs also in the Sophoreae and Millettieae, and the presence of canavanine is shared with the Bossiaeeae, Mirbelieae, and Millettieae.

Clearly, *Hypocalyptus* seems to fit neither in the Podalyrieae, nor the Sophoreae, nor the Australian Bossiaeeae or Mirbelieae. Even the Millettieae, with which it shares a number of characters, deviate in having complex pseudoracemose inflorescences and diadelphous or pseudomonadelphous stamens, with two fenestrellae at the base of the stamen tube. Furthermore, in this tribe a nectar disk is generally present, and chemical compounds, such as pterocarpans, arylcoumarins, and rotenoids, are produced (Geesink, 1981; Sousa & Pena de Sousa, 1981). None of these characters have been located in *Hypocalyptus*.

Despite the mentioned similarities, there is no convincing evidence to support a direct link between *Hypocalyptus* and any of the investigated tribes. In the past, several eminent scientists (e.g., Bentham, Polhill, Dahlgren), with vast insights into relationships in the Papilionoideae, have allocated *Hypocalyptus* to various tribes, but have consistently found it to be an odd genus with no obvious relationships. We therefore conclude and propose that the genus be assigned separate tribal status and perhaps be placed near the Millettieae, with which it shows signs of a possible affinity. In 1991, Yakovlev placed *Hypocalyptus* in a monotypic suprageneric group, but we propose tribal status, rather than subtribal status within the Podalyrieae, as the genus has no direct affinity with the Podalyrieae. An independent tribal position would emphasize the anomalous character combinations in

Table 2. Characters and character states used for the cladistic analysis of *Hypocalyptus* and the tribes Sophoreae, Millettieae, Podalyrieae, Mirbelieae, Bossiaeeae, Crotalarieae, Genisteae, and Thermopsideae. The fully resolved cladogram generated from this data set is shown in Figure 1.

Taxa	Character states			
Sophoreae	00000	00000	00000	0
Bossiaeeae	00101	0110?	?1001	0
Crotalarieae	10000	10001	10100	0
Genisteae	10110	10011	10110	1
Hypocalyptus	11100	00100	00001	1
Millettieae	00000	00000	00001	1
Mirbelieae	00101	01101	11001	0
Podalyrieae	01100	10101	10100	0
Thermopsideae	10110	000??	??110	0

Characters

1. Leaf type: pinnate, at least in some taxa (0); digitate or simple (1) (Polhill, 1981a; Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).
2. Calyx base: not intrusive (0); intrusive in most taxa (1) (Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).
3. Calyx upper lobes: not fused higher up (0); fused higher up to form an upper lip (1) (Polhill, 1981a; Van Wyk & Schutte, 1995).
4. Calyx lower lobes: not fused higher up (0); fused higher up to form a trifid lower lip (1) (Polhill, 1981a; Van Wyk & Schutte, 1995).
5. Corolla: without red guide marks (0); yellow with red guide marks (1) (Crisp & Weston, 1987; Van Wyk & Schutte, 1995).
6. Anther dimorphism: not dimorphic or slightly dimorphic (0); storngly dimorphic (1) (Polhill, 1981a; Van Wyk & Schutte, 1995).
7. Anther connective: narrow (0); broad and dark colored (1) (Crisp & Weston, 1987).
8. Seed aril type: non-fleshy (0); fleshy (1) (Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).
9. Seed aril shape: without a tongue-like extension (0); with a tongue-like extension (1) (Van Wyk & Schutte, 1995).
10. Seed micropyle type: ypsaloid (0); punctate (1) (Manning & Van Staden, 1987; Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).
11. Seed micropyle position: outside the hilum (0); inside the hilum or on the rim (1) (Manning & Van Staden, 1987; Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).
12. Giant antipodal cells: absent (0); present, at least in some taxa (1) (Crisp & Weston, 1995; Schutte, 1997).
13. Quinolizidine alkaloids: absent in most taxa (0); present in most taxa (1) (Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).
14. α-Pyridone alkaloids: absent in most taxa (0); present in most taxa (1) (Van Wyk & Schutte, 1995).
15. Canavanine: absent (0); present, at least in some taxa (1) (Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).
16. Stamens: free or fused into an open tube (0); fused into a closed tube (1) (Polhill, 1981a; Van Wyk & Schutte, 1995; Schutte & Van Wyk, 1997).

Hypocalyptus and indicate its incongruous position within the subfamily. The necessary taxonomic change is presented below, with a description of the tribe and a list of the species recognized.

Tribe **Hypocalypteae** (Yakovlev) A. L. Schutte, stat. nov. Based on: Liparieae (Bentham) Harvey subtribe Hypocalyptinae Yakovlev, Bobovye Zemnogo Shara, 87. 1991.

Tall erect shrubs or sprawling subshrubs. Leaves alternate, palmately trifoliolate, petiolate; leaflets oblanceolate to broadly obovate, mucronate, flat; stipules linear. Inflorescences terminal, racemose, 2–50-flowered. Bracts linear to lanceolate, sometimes laterally denticulate, usually caduçous. Bracteoles linear to lanceolate. Calyx intrusive at base; upper two lobes fused higher up than lower three lobes; carinal lobe as long as the other lobes. Corolla violet, mostly with a yellow nectar guide on the standard petal, glabrous. Standard ovate to circular; apex emarginate or mucronate. Wing petals longer than the keel, elongate, rounded, with the apical part much widened, auriculate; petal sculpturing present. Keel petals semicircular, with a small pocket; apex shortly to strongly beaked. Stamens 10, filaments fused into a closed tube; anthers slightly dimorphic, alternately dorsifixed and basifixed. Pistil stipitate; ovary glabrous, 3–30-ovuled; style curved upward, glabrous. Pods chartaceous, linear, oblong or ovate, laterally compressed or inflated, stipitate, beaked; 5–6-seeded. Seeds obovate, reniform or oblong; hilum elliptic; aril fleshy, collar-like, continuous around the hilum. Chromosome number $2n = 20$. 1 genus with 3 species.

The synopsis presented here has been taken from Dahlgren's (1972) revision of the genus. Full synonymy of the species recognized is not reiterated here.

Hypocalyptus Thunberg, Prod. Pl. Cap., 124. 1800. TYPE: *Hypocalyptus sophoroides* (P. J. Bergius) Baillon.

Crotalaria L. sect. *Purpureae* Bentham, in Hooker, Lond. J. Bot. 2: 590. 1843. TYPE: *Crotalaria purpurea* Ventenat [= *Hypocalyptus coluteoides* (Lamarck) Dahlgren].

Loddigesia Sims, in Curtis's Bot. Mag. 24: 965. 1806. TYPE: *Loddigesia oxalidifolia* Sims [= *Hypocalyptus oxalidifolius* (Sims) Baillon].

1. **Hypocalyptus sophoroides** (P. J. Bergius) Baillon, Hist. Pl. 2: 336. 1870. *Spartium sophoroides* P. J. Bergius, Descr. Pl. Cap., 141. 1767. TYPE: Without locality, *Anon. s.n.* (holotype, SBT).

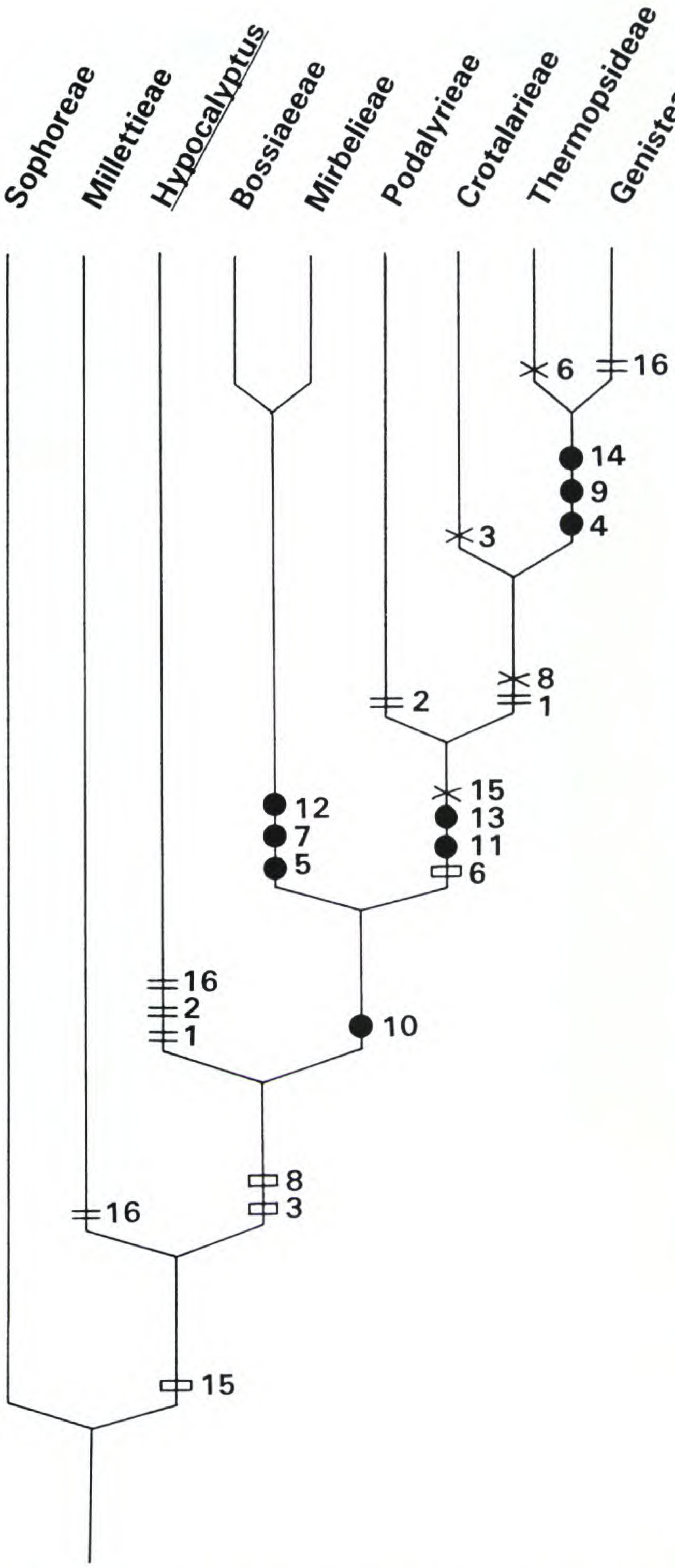


Figure 1. Fully resolved cladogram of relationships at the tribal level, based on the data set in Table 2. Dot, an apomorphy without homoplasy; open box, an apomorphy with subsequent reversal; =, a convergence; x, a reversal.

2. **Hypocalyptus coluteoides** (Lamarck) Dahlgren, in Bot. Not. 125: 108. 1972. *Crotalaria coluteoides* Lamarck, Encycl. 2: 200. 1786. TYPE: Without locality, *Anon. s.n.* (holotype, P-LAM).
3. **Hypocalyptus oxalidifolius** (Sims) Baillon, Hist. Pl. 2: 336. 1870. *Loddigesia oxalidifolia* Sims, Curtis's Bot. Mag. 24: 965. 1806. TYPE: "*Loddigesia oxalidifolia*," plate 965. 1806. (iconotype).

Acknowledgments. This study formed part of the first author's Ph.D. thesis in Botany at the Rand Afrikaans University. Financial support from the Rand Afrikaans University and Foundation for Research Development is acknowledged.

Literature Cited

Bell, E. A., J. A. Lackey & R. M. Polhill. 1978. Systematic significance of canavanine in the Papilionoideae (Faboideae). Biochem. Syst. & Ecol. 6: 201–212.

Bentham, G. 1837. Commentationes de Leguminosarum Generibus. Sollinger, Vienna.

———. 1839. De Leguminosarum Generibus. Ann. Wiener Mus. Naturgesch. 2: 62–142.

———. 1844. Enumeration of Leguminosae, indigenous to southern Asia, and central and southern Africa. London J. Bot. 3: 338–365.

———. 1865. Leguminosae. *In* G. Bentham & J. D. Hooker (editors), Genera plantarum, Vol. 1 (2). Lovell Reeve, London.

Bisby, F. A. 1981. Tribe 32. Genisteae (Adans.) Benth. Pp. 409–425 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

Crisp, M. D. & P. H. Weston. 1987. Cladistics and legume systematics, with an analysis of the Bossiaeeae, Brongniarteae and Mirbelieae. Pp. 65–130 *in* C. H. Stirton (editor), Advances in Legume Systematics 3. Royal Botanic Gardens, Kew.

———. 1995. Mirbelieae. Pp. 245–282 *in* M. D. Crisp & J. J. Doyle (editors), Advances in Legume Systematics 7. Royal Botanic Gardens, Kew.

Dahlgren, R. 1972. The genus *Hypocalyptus* Thunb. (Fabaceae). Bot. Not. 125: 102–125.

Farris, J. S. 1988. Hennig86 reference, version 1.5.

Geesink, R. 1981. Tribe 6. Tephrosieae (Benth.) Hutch. Pp. 245–260 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

Goldblatt, P. 1981. Cytology and the phylogeny of Leguminosae. Pp. 427–463 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 2. Royal Botanic Gardens, Kew.

Harvey, W. H. 1862. Leguminosae. Pp. 1–285 *in* W. H. Harvey & O. W. Sonder (editors), Flora Capensis, Vol. 2. Hodges, Smith, Dublin.

Hutchinson, J. 1964. The Genera of Flowering Plants, Vol. 1. Oxford Univ. Press, Oxford.

Manning, J. C. & J. Van Staden. 1987. The systematic significance of testa anatomy in the Leguminosae——An illustrated survey. S. African J. Bot. 53: 210–230.

Polhill, R. M. 1976. Genisteae (Adans.) Benth. and related tribes (Leguminosae). Bot. Syst. 1: 143–368.

———. 1981a. Papilionoideae. Pp. 191–208 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

———. 1981b. Tribe 2. Sophoreae Sprengel. Pp. 213–230 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

———. 1981c. Tribe 25. Mirbelieae (Benth.) Polhill. Pp. 391–392 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

———. 1981d. Tribe 26. Bossiaeeae (Benth.) Hutch. Pp. 393–395 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

———. 1981e. Tribe 27. Podalyrieae Benth. Pp. 396–397 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

———. 1981f. Tribe 28. Liparieae (Benth.) Hutch. P. 398 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

———. 1981g. Tribe 29. Crotalarieae (Benth.) Hutch. Pp. 399–402 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

———. 1994. Classification of the Leguminosae. *In* F. A. Bisby, J. Buckingham & J. B. Harborne (editors), Phytochemical Dictionary of the Leguminosae. Chapman & Hall, London.

Schutte, A. L. 1995. A Taxonomic Study of the Tribes Podalyrieae and Liparieae (Fabaceae). Unpublished Ph.D. Thesis, Rand Afrikaans University, Johannesburg.

———. 1997. A survey of antipodals in the gametophyte of the tribes Podalyrieae and Liparieae (Fabaceae). Bothalia 27 (1). (in press).

——— & B-E. Van Wyk. 1997. Evolutionary relationships in the tribes Podalyrieae and Liparieae, based on morphological, cytological and chemical evidence. Pl. Syst. Evol. (in press).

Sousa, M. & M. Pena de Sousa. 1981. New world Lonchocarpinae. Pp. 261–281 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

Turner, B. L. 1981. Tribe 31. Thermopsideae Yakovlev. Pp. 403–407 *in* R. M. Polhill & P. H. Raven (editors), Advances in Legume Systematics 1. Royal Botanic Gardens, Kew.

Wyk, B.-E. Van & A. L. Schutte. 1995. Phylogenetic relationships in the tribes Podalyrieae, Liparieae and Crotalarieae. Pp. 283–308 *in* M. D. Crisp & J. J. Doyle (editors), Advances in Legume Systematics 7. Royal Botanic Gardens, Kew.

———, P. J. D. Winter & A. L. Schutte. 1994. Chemotaxonomic value of anthocyanins in the tribe Liparieae (Fabaceae). Biochem. Syst. & Ecol. 23: 295–297.

Yakovlev, G. P. 1991. Bobovye Zemnogo Shara. Nauka, St Petersburg.

A New Species of *Leptochloa* (Poaceae, Chloridoideae) from Sri Lanka

Neil Snow

Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A. Current address: Department of Biological Sciences, University of Northern Colorado, Greeley, Colorado 80639, U.S. A.

ABSTRACT. *Leptochloa srilankensis* N. Snow is described and diagnosed from the morphologically similar *L. decipiens* subsp. *asthenes* (formerly *L. ciliolata*) and previously misidentified specimens of *L. panicea* subsp. *panicea*. The species is restricted to Sri Lanka and is known from only five collections.

An undescribed species of *Leptochloa* P. Beauvois from Sri Lanka has become apparent during preparation of a recent monograph of the genus (Snow, 1997). Sufficient loan material has been seen now to verify its morphological distinctness and permit a reasonably complete description and diagnosis.

Leptochloa srilankensis N. Snow, sp. nov. TYPE: Sri Lanka. Northern Province, Vavuniya District, ca. 3 mi. SW of Nedunkaní along the road to Puliyankulam, near mile post 21/3, 5 Dec. 1974, *Davidse & Sumithraarachchi 9066* (holotype, MO; isotypes, BRI, K, TAES, US). Figures 1, 2.

Haec species *Leptochloae decipienti* subsp. *astheni* similis, sed ligula trichomatibus apicalibus longis vestita, lamina foliari longitudinem centimetrorum quatuor non attingente, spicula perbrevi ex flosculis duabus tantum constante ac lemmatibus perlate ovatis differt.

Perennial. Culms erect or ascending to 60 cm tall, arising from knotted and cataphyll-bearing bases, the older bases persistent and sometimes resembling short rhizomes. Culms terete, 0.5–1.0 mm wide basally (excluding sheaths) to ca. 0.5 mm wide below panicle, solid but with soft central pith, sometimes branching below, glabrous. Internodes numerous, 0.6–1.0 cm long basally to ca. 14 cm long apically. Sheaths open, tightly involute upon drying, ca. 1.5 times length of lower internodes to ca. 0.80 times length of upper internodes, moderately pilose from small tuberculate bases, especially near collar, becoming glabrous with age. Ligule a short membrane topped by long (or rarely short) straight apical hairs 1.0–4.0 mm long. Leaf blades narrowly lanceolate (adjectives sensu Systematics Association, 1962), somewhat cartilaginous at collar, ca. 3.0 mm wide at base, mostly less than 4.0 cm long, tightly involute upon drying, glabrous above and below. Inflorescence a panicle of spicate or racemose primary branches, up to 40 cm long fully exserted, ca. 5 cm wide basally to ca. 1 cm wide apically; panicle branches 15–20, 1.5–5.0 cm long, alternate, ascending to erect, slightly flexuous; rachis and branch axils glabrous. Spikelets 1.2–1.3(–1.7) mm long, distant to barely overlapping, ± secund in two rows. Glumes 1-nerved, membranous, lanceolate, scabrous on keel, sometimes with fine longitudinal striations, the lower (0.7–)0.9–1.1 mm long, the upper 1.1–1.3 mm long and sometimes slightly exceeding upper floret. Florets 2 (rarely 3), the third floret when present often highly reduced. Rachilla between first and second floret strongly arched. Lemmas thinly membranous to hyaline, strongly keeled, very widely ovate (Fig. 2), 0.7–1.0 mm long, 3-nerved (lateral nerves visible only near base with high magnification), broadly acute at apex, sparsely sericeous along lower nerves to nearly glabrous. Palea subequal to lemma, hyaline, sparsely sericeous along veins. Anthers three, ca. 0.3 mm long. Stigmas two, plumose. Caryopsis elliptic in hilar profile, widely depressed obovate in cross section at midpoint, ungrooved or sometimes with a slight hilar depression, dark amber to light brown, smooth.

Chromosome number unknown. Details concerning lemmatal micromorphology have been published elsewhere (Snow, 1996, as *Leptochloa* "sp. nov.").

Vernacular name. Srilankan sprangletop.

Leptochloa srilankensis is most easily confused with the eastern Australian endemic *L. decipiens* (R. Brown) Stapf ex Maiden subsp. *asthenes* (Roemer & Schultes) N. Snow (Snow, 1998) (formerly known as *L. ciliolata* (E. Jedwabnick) S. T. Blake; Lazarides, 1980; Simon, 1993). Specimens of *L. decipiens* subsp. *asthenes* with relatively short leaves

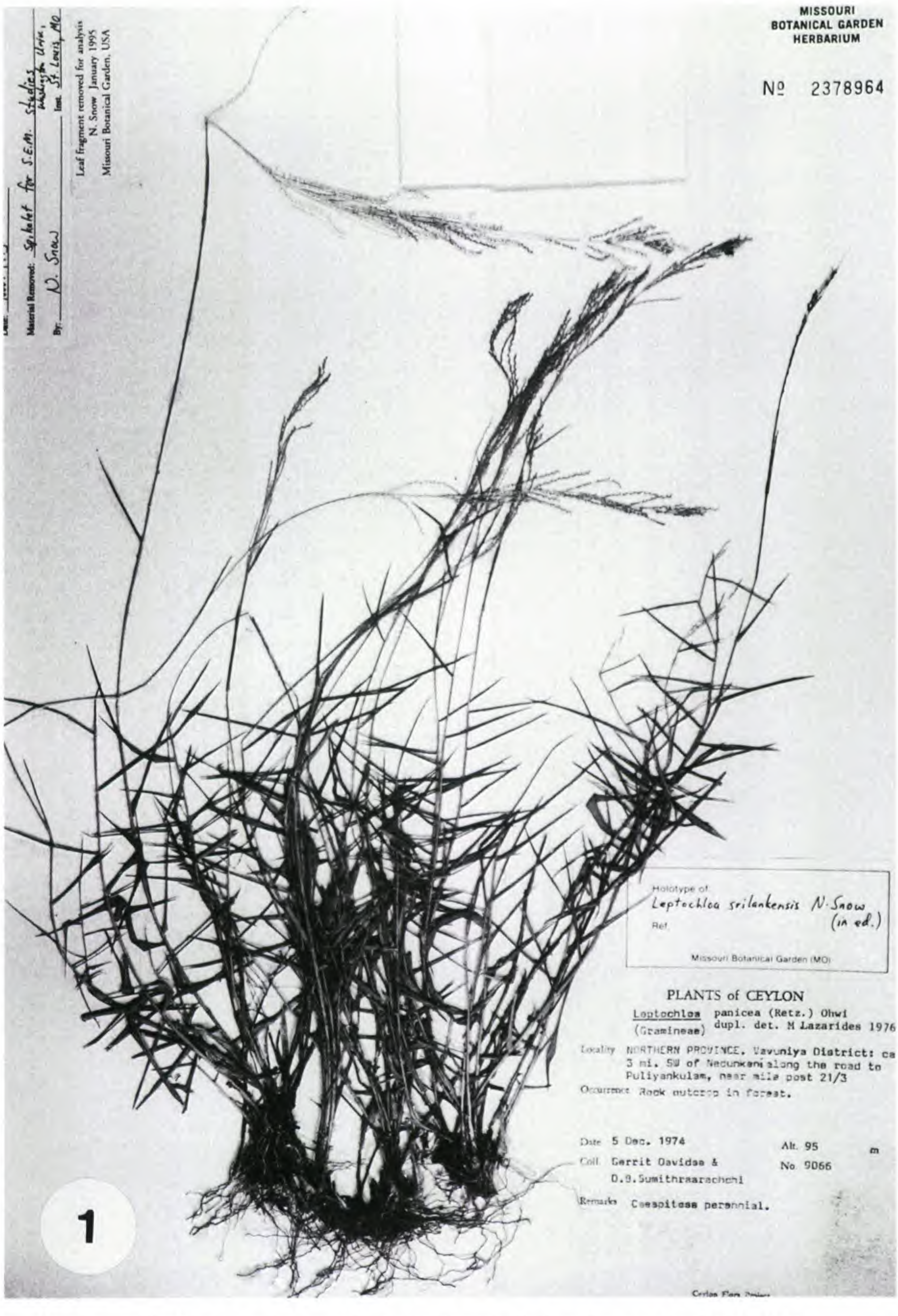


Figure 1. Holotype of *Leptochloa srilankensis* N. Snow, *Davidse & Sumithraarachchi 9066* (MO).

and short panicle branches superficially resemble *L. srilankensis*, but the ciliate ligule, the long panicle, and the reduced number of florets are diagnostic characters. The dissimilarities of the two are summarized in Table 1.

The species also could be confused with *L. panicea* (A. J. Retzius) J. Ohwi subsp. *panicea* (sensu Snow, 1997), and some literature citations of specimens here placed in *L. srilankensis* have been attributed to *L. panicea*. In his treatment of *Leptochloa* for Sri Lanka, Lazarides (1994: 301) included statements for *L. panicea* that clearly reflect the morphology of *L. srilankensis*, such as ". . .ligules ciliate with hairs up to 3 mm long. . ." and ". . .leaf sheaths tight, chartaceous with scarious margins, longer than the lower internodes and shorter than

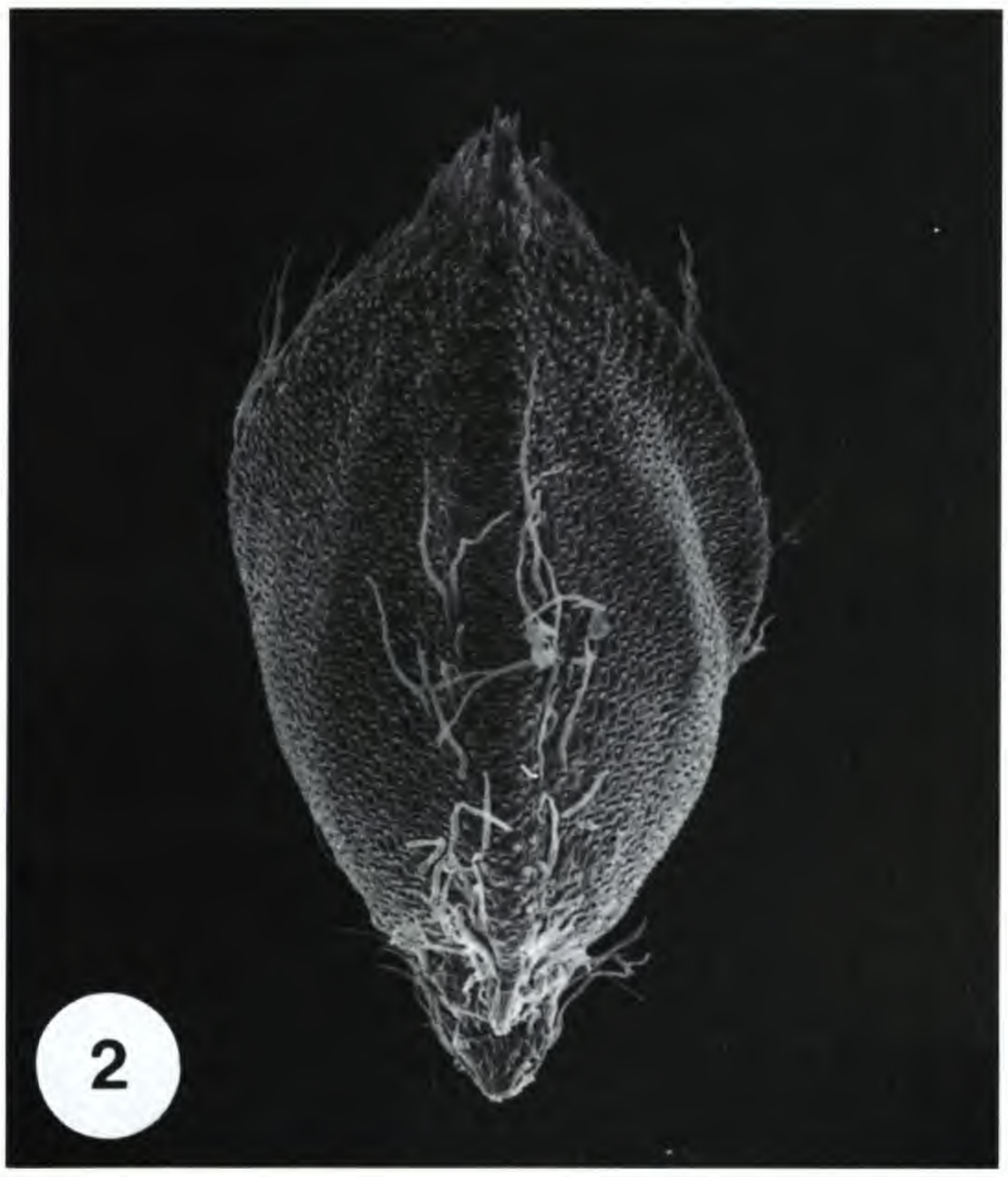


Figure 2. Scanning electron microscopy image of caryopsis-bearing lemma from holotype. Note widely ovate shape of lemma. (Scale: lemma length = 0.7 mm.)

the upper internodes." Two specimens of *L. panicea* cited for Sri Lanka by Lazarides (1994) (*Clayton 5591*, *Mueller-Dombois & Cooray 67121003*) are here presented as paratypes. Handwritten notes attached to certain specimens (*Clayton 5591*, TAES; *Fosberg et al. 50835*, K) indicate others had also recognized its distinctive morphology. Table 1 summarizes important diagnostic differences between these taxa.

The ecological distribution of *Leptochloa srilankensis* includes sandy soils in open areas of thornscrub, rock outcrops in forests, evergreen scrub, and roadsides. The specific epithet *srilankensis* refers to its geographical distribution in Sri Lanka.

Since only five collections are known, additional attempts to collect the plant should be a priority and will serve to more accurately assess its conservation status. The author would greatly appreciate viable seed of this species in order to better document its biological attributes.

Paratypes. SRI LANKA. **Puttalam District:** Northwestern Province, Wilpattu National Park, Puttalam–Mannar road, N from Marai villu, *Clayton 5591* (CANB, K, TAES); Wilpattu National Park, 2.5 mi. S of Maduru Odai, 5 mi. S of Marai Villu, Plat W 18, *Fosberg, Mueller-Dombois, Wirawan, Cooray & Balakrishnan 50835* (CANB, K); Ruhuna National Park, Block I opposite Karaugaswala, in evergreen scrub on sand, *Mueller-Dombois & Cooray 67121003* (PDA, POM); on Palatupan road near Rakinawala on roadside, *Cooray 69111819R* (K).

Acknowledgments. The Missouri Botanical Garden (Andrew W. Mellon Foundation) and Washington University (Population and Evolutionary Biology Program) are acknowledged for their generous financial and logistical support over the past six years. The curators of BRI, CANB, K, POM, and TAES graciously sent material on loan. My thanks to Roy Gereau for the Latin diagnosis and to Mike Veith at the Electron Microscopy facility at Washington University. The comments of Mike Lazarides on an earlier draft were helpful. This paper represents a contribution toward the author's doctoral dissertation at Washington University (St. Louis).

Literature Cited

Lazarides, M. 1980. The genus *Leptochloa* Beauv. (Poaceae, Eragrostideae) in Australia and Papua New Guinea. Brunonia 3: 247–269.

———. 1994. *Leptochloa.* Pp. 297–303 *in* M. D. Dassan-

Table 1. Diagnostic differences between *Leptochloa srilankensis*, *L. decipiens* subsp. *asthenes*, and *L. panicea* subsp. *panicea* (Snow, 1997).

	L. srilankensis	*L. decipiens* subsp. *asthenes*	*L. panicea* subsp. *panicea*
Habit	perennial	perennial	annual
Root crown	knotted	often knotted	not knotted
Upper internodes	elongated	short	short
Leaf blade length	< 4 cm	4–8 cm	3–25 cm long
Blade vestiture	glabrous	scabrous	tuberculate pilose
Leaf midrib	absent	generally absent, present in some	present
Ligule apex	long ciliate	erose	erose
Floret number	2(3)	3–4(7)	2–3
Lemma shape	very widely ovate	ovate	elliptic
Lemma apex	broadly acute	obtuse to emarginate	acute
Panicle length	always > ½ plant length	generally < ½ plant length	usually < ½ plant length
Distribution	Sri Lanka	New South Wales, Queensland	Africa, Asia

ayake (editor), A Revised Handbook to the Flora of Ceylon, Vol VIII. Amerind Publishing, New Delhi.

Simon, B. K. 1993. A Key to Australian Grasses, 2nd ed. Department of Primary Industries, Brisbane.

Snow, N. 1996. The phylogenetic utility of lemmatal micromorphology in *Leptochloa* s.l. and related genera in subtribe Eleusininae (Poaceae, Chloridoideae, Eragrostideae). Ann. Missouri Bot. Gard. 83: 504–529.

———. 1997. Phylogeny and Systematics of *Leptochloa* P. Beauv. sensu lato (Poaceae, Chloridoideae). Ph.D. Dissertation, Washington University, St. Louis.

———. 1998. Nomenclatural changes in *Leptochloa* P. Beauvois sensu lato (Poaceae, Chloridoideae). Novon 8: 77–80.

Systematics Association Committee for Descriptive Biological Terminology. 1962. I. Terminology of Simple Symmetrical Plane Shapes (Chart 1). Taxon 11: 145–156.

An Infrageneric Classification for *Poa* in North America, and Other Notes on Sections, Species, and Subspecies of *Poa*, *Puccinellia*, and *Dissanthelium* (Poaceae)

Robert J. Soreng

Department of Botany, MRC–166, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. An infrageneric classification for the genus *Poa* L. in North America, new taxa, combinations, names, hybrid status, and lectotypes are proposed for forthcoming treatments of the genus in the Americas. New names, combinations, and taxa are: *Dissanthelium atropidiforme* (Hackel) Soreng, *D. atropidiforme* var. *patagonicum* (Parodi) Soreng, *D. calycinum* subsp. *mathewsii* (Ball) Soreng, *Poa* sect. *Alpinae* (Hegetschweiler ex Nyman) Soreng, *P.* sect. *Dasypoa* (Pilger) Soreng, *P.* sect. *Sylvestres* V. L. Marsh ex Soreng, *P. arnowiae* Soreng, *P. chambersii* Soreng, *P. tovari* Soreng, *P. unilateralis* subsp. *pachypholis* (Piper) D. D. Keck ex Soreng, *P.* ×*gaspensis* Fernald, and *Puccinellia atacamensis* (Parodi) Soreng. Lectotypes are proposed for the following taxa: *Dissanthelium sclerochloides* Steudel ex E. Fournier, *Poa* [unranked] *Arenariae* Hegetschweiler, *Poa* [unranked] *Caespitosae* Fries ex Lange, *Poa* [unranked] *Fasciculiferae* Fries ex Lange, *Poa* [unranked] *Glareosae* Hegetschweiler, *Poa* [unranked] *Hydrophilae* Hegetschweiler, *Poa* [unranked] *Macranthela* K. Koch, *Poa* [unranked] *Micranthela* K. Koch, *Poa* [unranked] *Stoloniferae* Fries ex Lange, *Poa* [unranked] *Subbulbosae* Fries ex Andersson, *Poa* sect. *Incanae* V. Jirásek, *Poa* sect. *Nervosae* Rouy, *Poa* sect. *Obsoletae* Rouy, *Poa* sect. *Spizopoa* Dumortier.

In the course of working on *Poa* for North America (Soreng, 1985, 1990, 1991a, 1991b, 1986; Soreng & Hatch, 1983) it became apparent that the number of sections of *Poa* needed to be expanded, and the taxonomy of certain introduced Old World and circumboreal sections needed to be straightened out. Some of the changes proposed here stem from the results of chloroplast DNA (cpDNA) restriction site analyses for the genus. Other changes stem from a better understanding of the importance of the branching system to the taxonomy of *Poa*, and experience gained through having worked with the genus for 20 years. Physiographic divisions for distributions follow Takhtajan (1986). In addition, two new species are described, and five new combinations and one new name are proposed.

A. TWO NEW SECTIONS OF *POA*

Poa [subg. *Poa*] sect. **Dasypoa** (Pilger) Soreng, comb. et stat. nov. Basionym: *Dasypoa* Pilger, Bot. Jahrb. Syst. 25: 716. 1898. TYPE: *Dasypoa tenuis* Pilger (= *Poa conglomerata* Ruprecht ex Peyritsch).

Slender, caespitose, annuals or short-lived perennials, without rhizomes, to 30 cm tall; branching intravaginal; leaf sheaths weakly keeled to terete, not persisting on the plant for more than one season, without bulbous thickened bases, those of the uppermost culm leaves closed ¼–⅖ their length; leaf blades thin, flat, lax, at most sparsely scabrous above, with two lengthwise adaxial grooves, one on either side of the central vascular bundle; panicles densely flowered, cylindrical, somewhat lobed; spikelets 2–3-flowered; lemmas mostly 1–3 mm long, strongly to obscurely 5-veined, strongly keeled, sparsely pubescent (rarely glabrous); florets with one or three tufts of hair on the callus (callus rarely glabrous); palea keels scabrous and sometimes strigose below; flowers perfect, with three anthers 0.3–0.5 mm long.

Species included: *Poa conglomerata* Ruprecht ex Peyritsch, of the volcanic highlands of central Mexico and Guatemala, and *P. parviceps* Hackel and *P. scaberula* Hooker f. (= *P. conglomerata*), Andean and Chile-Patagonian regions of South America and Tierra del Fuego.

Watson and Dallwitz (1992) placed the genus *Dasypoa* Pilger in tribe Aveneae, without explanation, whereas Clayton and Renvoize (1986) placed it in synonymy within *Poa*. Tzvelev (1989) recognized the genus as a member of his broadly defined tribe Poeae (including Aveneae). On morphological grounds the type of the genus, *Dasypoa tenuis*, cannot be distinguished from *Poa*. *Poa conglomerata*, which is not morphologically distinct from *P. scaberula* (under which *D. tenuis* has been synonymized in the past), shares derived cpDNA restriction sites with cpDNA "group IV" species (see section D, below), including sections *Homalopoa*,

Madropoa, and *Dioicopoa* (Soreng, 1990). For discussion and synonymy of South American species of *P.* sect. *Dasypoa*, see Parodi (1962) [excluding *P. atacamensis* Parodi, = *Puccinellia* sp. (see section F, below), and *P. darwiniana* Parodi]. As there is little or no difference between the North American *P. conglomerata* and the South American *P. scaberula*, there is no reason to treat them as distinct species. Although Parodi counted *P. darwiniana* of Tierra del Fuego among related species, I have reservations about including it in section *Dasypoa*. This species lacks any hair on the florets, the lemmas are abruptly and stoutly short-awned (a peculiar trait for *Poa*), the ligules are lacerated, and the abaxial surface of the blades are abundantly hispidulous and have more than two grooves. *Poa darwiniana* may be related to *Poa flabellata* Lamarck, *P. cookii* (Hooker f.) Hooker f., and *P. ramosissima* Hooker f. of the Antarctic Islands, but more study is needed of this set of taxa, and I am not yet convinced *P. darwiniana* belongs in *Poa*.

Poa [subg. *Poa*] sect. **Sylvestres** V. L. Marsh ex Soreng, sect. nov. TYPE: *Poa sylvestris* A. Gray.

Plantae perennes caespitosae; innovationes plerumque pseudointravaginales; culmi vaginis connatis ad 1/10–apices; ligulae lacerae usque ad 4 mm longae; laminae planae sine pilis, apice non cucullato; panicularum rami scabri patuli, spiculis distalibus; callus arachnoideus (eo *P. autumnali* excepto); lemmae glabrae vel pubescentes, nervis lateralibus prominentibus, marginibus et apicibus anguste membranaceis pellucidis vel lactineis; flores hermaphroditi, antheris 0.5–2.0 mm longis.

Perennials; caespitose or rhizomatous (*Poa kelloggii*); shoots pseudointravaginal, or intravaginal (*P. autumnalis*), the pseudointravaginal prophylls mostly fused for more than half their length, and the first true shoot leaves usually without a developed blade; sheaths moderately to weakly keeled, those of the upper culm leaves with margins fused from 1/10 to over the whole length; ligules of upper leaves lacerate less than 4 mm long; leaf blades flat, soft, the tips acute, with costal and sometimes intercostal hooks, with one lengthwise adaxial groove on either side of the central vascular bundle, with prominent abaxial central nerves; panicles open, the main axis internodes elongate, over 3 cm long (except in *P. sylvestris*), the branches sparsely to densely scabrous on the angles, flowered in the distal 1/4 (1/3); spikelets 2–3-flowered, the third rachilla internode often more than 1.0 mm long; lemmas strongly keeled, strongly 5-veined, the narrow hyaline apex and margins clear or whitish, often acuminate, but sometimes obtuse and blunt, usually glabrous throughout, less often sparsely villous only on the keel (*P. alsodes*), or pubescent on the keel and marginal nerves (*P. autumnalis* and *P. sylvestris*), and rarely between the nerves (*P. autumnalis* and *P. sylvestris*); callus with a single dorsal web of crinkled hairs (glabrous in *P. autumnalis*); flowers perfect, anthers 0.5–2.0 mm long.

Species included: *Poa alsodes* A. Gray, *P. autumnalis* Muhlenberg, *P. kelloggii* Vasey, *P. marcida* Hitchcock, *P. saltuensis* Fernald & Wiegand, *P. sylvestris* A. Gray. All the species are native to North America, principally occurring in the Atlantic Region, Appalachian Province, with a secondary distribution in the Coast Ranges of the Vancouverian Province of the Rocky Mountain Region.

Chloroplast DNA restriction site data (for *Poa alsodes*, *P. autumnalis*, and *P. saltuensis*) suggest that this group is old and early diverging within *Poa* (Soreng, 1990). Members of the section examined have distinctly different chloroplast restriction site patterns from other sections, except *P.* sect. *Arctopoa* (Grisebach) Tzvelev (Soreng, 1990). *Poa* sect. *Sylvestres* is morphologically and ecologically far removed from the arctic and mainly Asian, halophytic *P.* subg. *Arctopoa*. Members of *P.* sect. *Sylvestres* are primarily restricted to rich forest soils with a strong deciduous tree component. They occur in low mountains of eastern and far western North America, and are perhaps a relictual element of a mid-Tertiary vicariance event between North American and Laurasian *Poa*.

New cpDNA restriction site data suggest *Poa marcida* Hitchcock belongs to this group (Soreng, unpublished). Morphologically *P. marcida* and *P. kelloggii* Vasey are not separable from the eastern North American members of the section. Although *P. bolanderi* Scribner has similar spikelets and lacks pubescence on the lemma, it is excluded because it is an annual and has extravaginal branching. Despite the section's putatively early origin within the genus, the species do have the single web on the back of the callus, typical of many species of *Poa*, but absent outside the genus (with one exception; see comments under *Dissanthelium* in section F, below). The morphological boundaries of *P.* sect. *Sylvestres* blur into *P.* sect. *Homalopoa*, and to some extent *P.* sect. *Oreinos* Ascherson & Graebner. The following species are difficult to assign to these sections on morphology alone: *P. autumnalis*, *P. chapmanniana* Scribner, *P. howellii* Vasey & Scribner, *P. laxiflora* Buckley, *P. leptocoma* Trinius s. str., *P. wolfii* Scribner; more work is needed to understand the affinities of these species.

B. On *Poa* Section *Dioicopoa*

The infrageneric nomenclature and taxonomy of the following group need clarification of rank.

Poa [subg. *Poa*] sect. **Dioicopoa** (E. Desvaux) Bentham, J. Linn. Soc., Bot. 19: 125. 1881. Basionym: *Poa* [unranked] *Dioicopoa* E. Desvaux, in C. Gay, Flora of Chile, 6: 413. 1853. *Poa* subg. *Dioicopoa* (E. Desvaux) J. R. Edmondson, J. Linn. Soc., Bot. 76: 331. 1978. TYPE: *Poa chilensis* Trinius (= *P. denudata* Steudel) (lectotype, designated by Keng (1959: 163)).

Species dioecious, different sex plants slightly dimorphic or not; perennials, rhizomatous or caespitose and sometimes with moderately bulbous thickened sheaths at the base of the plant; branching extra- and intravaginal; uppermost culm sheaths closed only near the base or up to ⅔ the length; leaf blades glabrous, flat or folded, with two lengthwise adaxial grooves, one on either side of the central vascular bundle; panicles dense, cylindrical to narrowly lanceolate or ovate, often somewhat lobed; spikelets numerous, crowded; lemmas strongly keeled, with long silky hairs on the keel and marginal and sometimes lateral veins, or glabrous, the pubescence of pistillate florets often much more abundant than that on staminate florets and always [?] present, lemmas of staminate florets sometimes glabrous; callus hairs long and plicate (not woolly as in most *Poa*, except in *P. hubbardiana*, where the copious hairs surround the callus but are still longer and more concentrated beneath the keel and marginal nerves, and *P. bergii*; rarely straight, except in *P. pogonantha*, and less so in *P. tristigmatica*), and, when present, originating in tufts from three points (below the keel, and below each marginal vein); anthers in staminate plants 1.5–3(4.5) mm long.

Species included: *Poa alopecurus* (Gaudichaud ex Mirbel) Kunth, *P. arachnifera* Torrey, *P. arechavaletae* Parodi, *P. barrosiana* Parodi, *P. bergii* Hieronymus and var. *chubutensis* Spegazzini, *P. boecheri* Parodi, *P. boelckei* Nicora, *P. bonariensis* (Lamarck) Kunth, *P. buchtienii* Hackel, *P. calchaquiensis* Hackel, *P. chilensis* Trinius (= *P. denudata* Steudel), *P. commersonii* Franchet (= *P. rigidifolia* Steudel), *P. curva* Nees (= *P. tristigmatica* E. Desvaux), *P. decolorata* Pilger (= *P. resinulosa* Nees ex Steudel), *P. denudata* Steudel, *P. dolichophylla* Hackel, *P. dusenii* Hackel, *P. eligulata* Hackel, *P. fuegiana* (Hooker f.) Hackel ex Dusén (= *P. alopecurus* subsp. *fuegiana* D. M. Moore & Doggett), *P. hubbardiana* Parodi, *P. ibari* Philippi, *P. iridifolia* Hauman, *P. lanigera* Nees, *P. lanuginosa* Poiret, *P. ligularis* Nees, *P. megalantha* (Parodi) Herter, *P. montevidensis* Arechavaleta, *P. nahuelhuapiensis* Nicora, *P. obvallata* Steudel (= *P. tristigmatica* E. Desvaux), *P. pachypogon* Nees (= *P. tristigmatica* E. Desvaux), *P. patagonica* Philippi, *P. patagonica* var. *neuquina* Nicora, *P. pedersenii* Nicora, *P. pilcomayensis* Hackel, *P. pilcomayensis* var. *calamagrostidea* Hackel, *P. poecila* Philippi, *P. pogonantha* (Franchet) Parodi (= *P. alopecurus* subsp. *fuegiana* D. M. Moore & Doggett), *P. prichardii* Rendle, *P. resinulosa* Nees ex Steudel, *P. reitzii* Swallen, *P. rigidifolia* Steudel, *P. schizantha* Parodi, *P. sellowii* Nees, *P. shuka* (Spegazzini) Parodi, *P. spiciformis* (Steudel) Hauman & Parodi (= *P. poecila* Philippi), *P. stuckertii* (Hackel) Parodi, *P. stuckertii* var. *megalantha* Parodi (= *P. megalantha* (Parodi) Herter), *P. subaristata* Philippi (= *P. tristigmatica* E. Desvaux), *P. superata* Hackel, *P. superbiens* (Steudel) Hauman & Parodi, *P. trachyantha* Hackel, *P. tristigmatica* E. Desvaux, *P. umbrosa* Trinius (= *P. sellowii* Nees), *P. uruguayensis* Parodi, and *P. vaginiflora* Steudel (= *P. denudata* Steudel).

In caespitose species the sheaths at the bases of plants may be moderately bulbous and indurate. Upper culm leaf sheaths may be closed only near the base, or up to ⅔ their length. An unusually high degree of variation exists in the length that the sheath is open in many species of *P.* sect. *Dioicopoa*, when compared to most other species of *Poa*. This variation comes from the tendency of the sheath margins to fuse for irregular distances within the region of overlapping folds, whereas in most other species of *Poa* the margins fuse where they meet or just above the lower end of the overlap. The species of the section differ from the dioecious members of *P.* sect. *Madropoa* chiefly in the absence of adaxial pubescence on the leaf blades and the presence of three tufts of plicate hairs on the calluses of lemmas. Although there was no chloroplast DNA restriction site support for or against the monophyly of *P.* sect. *Madropoa*, restriction site analysis showed *P.* sect. *Dioicopoa* to be monophyletic and to be derived from the same group of species that gave rise to *P.* sect. *Madropoa* (Soreng, 1990, 1991a).

The section contains some 50 dioecious species mainly from the Chile-Patagonian Region of South America, and one from the southern Great Plains of North America (Anton & Connor, 1995). *Poa arachnifera* probably arrived in North America from South America, as its lower polyploid relatives occur there. The rank of section is preferable, since to treat *Dioicopoa* as a subgenus would make *Poa*

subg. *Poa* paraphyletic (Soreng, 1990). *Poa* subg. *Poa*, as recognized here, encompasses all species of *Poa*, except those belonging in *P.* subg. *Arctopoa* and *P.* subg. *Andinae* Nicora.

The formal rank of *Poa* [unranked] *Dioicopoa* E. Desvaux remained to be established until Bentham (1881) cited it as a section of *Poa*. Bentham stated that without more detailed study he could not divide the genus into natural groups, but several genera and sections had previously been proposed that apply to the genus *Poa*. Hackel (1887: 73) clearly applied it in the rank of section. Although Anton (1978) later took it up as Hackel's section, other authors used it as unranked or at the rank of subgenus. Nannfeldt (1935: 7) mistakenly began its use as a subgenus, citing Hackel as having "divided it into three subgenera, viz. *Eupoa*, *Dioicopoa*, and *Pseudopoa*." Parodi (1950: 182, apparently his first use of *Dioicopoa* with a stated rank), Torres (1970), and Nicora (1978) explicitly treated it as a subgenus, without citing the basionym. Edmondson (1978), inadvertently, but effectively, first validated it in the rank of subgenus.

Keng (1959) lectotypified *Poa* sect. *Dioicopoa* with *P. chilensis* Trinius. However, the two species he cited as members of the section from China (*P. pleurinodis* Keng ex Keng f. [= *P. grandis* Handel-Mazzetti], and a second species that remains a nomen nudum) are not dioecious, nor are they in my opinion directly allied to *Dioicopoa*. These two species are at least superficially close to species of the *P. nervosa* Vasey complex of North America in morphology, and also in apparently possessing a partially gynodioecious breeding system (Soreng & Hatch, 1983; Soreng, 1985).

Four South American dioecious species have thick, folded, rigid leaf blades, more like *Poa* sect. *Madropoa* than other species of section *Dioicopoa*, and lack a web on the lemma callus. *Poa cumingii* Trinius, *P. hueca* Parodi, *P. holciformis* J. Presl (including *P. chilensis* sensu E. Desvaux (not Trinius) and its var. *robustior* Philippi), and *P. indigesta* Parodi (the former three of *Dioicopoa*, "grupo Holicformes," Parodi, 1950: 182) seem better placed in *P.* sect. *Madropoa*. *Poa cumingii* (including *Distichlis ammobia* Philippi) may be closely allied to *P. douglasii* Nees of North America (Beetle, 1955; pers. obs.).

Also described as dioecious *Poa* from South America are: *P. araucana* Philippi, *P. dialystostachya* Philippi, *P. gayana* E. Desvaux, *P. pallens* Poiret, *P. paposana* Philippi, *P. stachyodes* Philippi, *P. tricolor* Nees ex Steudel, and *P. valdiviana* Philippi. I have not seen type or other material of *P. araucana* or *P. valdiviana*. The others are members of *P.* sect. *Dioicopoa*, but may be synonymous with one or more of the above species. *Poa stachyodes* appears to be a staminate specimen of *P. dialytostachya*. *Poa paposana* may be the same as *P. buchtienii*, and if so would be an older name for that species.

Species belonging to *Poa* subg. *Andinae* and *P. flabellata* Lamarck and relatives are excluded from *P.* sect. *Dioicopoa*. Species of *P.* subg. *Andinae* are gynodioecious, and all have other morphological features unlike *P.* sect. *Dioicopoa*, including leaf blades with more than two adaxial grooves, and lemmas with a crown of hairs on their calluses, or glabrous calluses, rather than isolated tufts of hairs (except for *P. robusta*). Species of *P.* sect. *Dioicopoa* historically have been described in *Arundo*, *Distichlis*, *Festuca*, *Koeleria*, and *Trisetum*, as well as *Poa*, but I have not attempted to gather together heterogeneric synonyms. Moreover, the above listing of species included in the section is intended only as a summary of past usage. The section needs revision.

C. On *Poa* Sections of Ascherson and Graebner

The correct names for some sections of *Poa* introduced from Europe need clarification. Ascherson and Graebner (1900) began their landmark treatment of *Poa* by discussing older classifications of *Poa* developed by Hegetschweiler (1838) and Nyman (1882), explicitly calling previously unranked taxa "Sectionen." Had they accepted these older names they would have effectively established previously unranked legitimate infrageneric names in the rank of section. However, they explicitly rejected those taxa and went on to produce their own classification for the genus, included elements of the older unranked groups within their own new sections, and did not mention those unranked groups of Hegetschweiler or Nyman again (with one exception; *Poa* [unranked] *Vagantes* Nyman (1882: 833), nom. nud., no type cited, was placed in *P.* sect. *Ochlopoa* Ascherson & Graebner, 1900). The dismissal of the groups of Hegetschweiler and Nyman in favor of their own sections was primarily a consequence of using the old circumscription method versus the modern type method, as the older infrageneric taxa tended to be very heterogeneous (Ascherson & Graebner, 1900).

These older infrageneric taxa are reiterated here to clarify their status. Some are naked names, some are superfluous, some are untypified, and others are automatically typified. Several of these group names were accepted by Stapf (1896) and Lindman

(1926), but because those authors did not assign them rank they remained unranked. Lindman (1926) considered some of the older names to have priority over those of Ascherson and Graebner (1900).

The Hegetschweiler names are all listed with full citation in the classification for *Poa* in North America, section D, below, where their typification is also dealt with.

Poa [unranked] *Alpinae* Hegetschweiler ex Nyman: Hegetschweiler provided the description and Nyman the name.

Poa [unranked] *Arenariae* Hegetschweiler: Hegetschweiler's *Arenariae* is apparently a descriptive name, because it is not taken from any of the three homonyms, *Poa arenaria* Retzius, Lamarck, or Willdenow ex Sprengel, as none of those were included, nor are synonyms of any of those species included in the group. *Arenariae* initially included only *P. bulbosa* and *P. concinna* Gaudin (≡ *P. perconcinna* J. R. Edmondson), two members of the *P. bulbosa* complex, and one of these should be selected as the lectotype (see *P.* sect. *Bolbophorum* in section D, below).

Poa [unranked] *Glareosae* Hegetschweiler: *Glareosae* is not based on any name in *Poa. Poa glareosa* (Trinius) Kunth (= *Eragrostis articulata* (Shrank) Nees), from Brazil, is nomenclaturally, morphologically, and geographically unrelated to any of the species Hegetschweiler included in his group.

Poa [unranked] *Hydrophilae* Hegetschweiler: The name *Hydrophilae* might have been derived from *P. hydrophila* Thuillier ex Steudel (nom. inval., as a synonym of *Poa serotina* Ehrhart), or *Poa hydrophila* Persoon, both of which are synonyms of *Poa palustris* L. Hegetschweiler included *P. palustris* Hegetschweiler (hom. illeg., non L.) in his group and *P. fertilis* Hegetschweiler (hom. illeg., non Host), both of which are probably synonymous with *P. palustris* L. Although Hegetschweiler specified "nob." after each of the latter illegitimate species, it appears that he intended it in the sense of emended description, not as new species. Thus, it is possible to infer that *P. hydrophila* Persoon should be the automatic type of the group. However, as Hegetschweiler made no mention of that name, it seems appropriate to select one of the other included species as the lectotype (see synonymy under *Poa* sect. *Pandemos* in section D, below).

Poa [unranked] *Nemorales* Hegetschweiler: The automatic type is the same as the (later designated) lectotype for the older section, *Poa* sect. *Stenopoa* Dumortier, which has priority.

Poa [unranked] *Pratenses* Hegetschweiler: This has as the automatic type the same species that is the automatic type of *Poa* sect. *Poa.*

Poa [unranked] *Silvaticae* Hegetschweiler ex Nyman: Hegetschweiler provided the description and Nyman the name. The automatic type is the same as the (later designated) lectotype for the older section, *Poa* sect. *Homalopoa* Dumortier, which has priority.

Ascherson and Graebner (1900) also mentioned three legitimate sections of Dumortier, but used only one of them in their formal classification. These were initially published as sections. Two of them were later lectotypified, and one lectotype is established in section D, below.

According to J. R. Edmondson (1975: 25), Ascherson and Graebner's (1900) ranks of infrageneric taxa are explicitly "indicated by means of a typographical convention of symbols, which was explained on the fly-leaf of the unbound parts of the Flora." Edmondson (1980) accepted these as Ascherson and Graebner's sections. In case there remains any doubt, Jirásek (1934, 1935a) also recognized these as Ascherson and Graebner's sections. Others (e.g., Tzvelev, 1972, 1974, 1976; Soreng, 1990), who were unaware of these fly-leaf notes, have considered Ascherson and Graebner's sections as unranked and attributed the rank of section to Jirásek (1935a).

Since there has been much confusion surrounding the ranks used by Ascherson and Graebner (1900) in the genus *Poa*, their classification is outlined below:

Poa subg. *Eupoa* Hackel 1889 (Ascherson & Graebner, 1900: 387) (nom. superfl., ≡ *Poa* subg. *Poa*).
(Unranked?) *Leptoneurae* Döll, Fl. Baden 1: 172. 1855 (Ascherson & Graebner, 1900: 387).
Poa sect. *Ochlopoa* Ascherson & Graebner, Syn. Mitteleur. Fl. 387. 1900 (species 1) TYPE: *Poa annua* L. (Ascherson & Graebner included: *Poa* [unranked] *Annuae* Fries ex Andersson, Pl. Scand. Gram. 47. 1852; Döll, Fl. Baden 172. 1855).
Poa sect. *Bolbophorum* Ascherson & Graebner, Syn. Mitteleur. Fl. 391. 1900.
Gesammtart *Poa bulbosa* L. (Ascherson & Graebner, 1900: 391; species 2–6).
Poa sect. *Oreinos* Ascherson & Graebner, Syn. Mitteleur. Fl. 400. 1900.
Gesammtart *Poa laxa* Haenke (Ascherson & Graebner, 1900: 401; species 7–8).
Poa sect. *Cenisia* Ascherson & Graebner, Syn.

Mitteleur. Fl. 404. 1900 (species 10). TYPE: *Poa cenisia* Allioni.

Poa sect. *Glaucopoa* Ascherson & Graebner, Syn. Mitteleur. Fl. 405. 1900 (species 11). TYPE: *Poa caesia* Smith (= *Poa* sect. *Stenopoa* Dumortier).

Poa sect. *Hylopoa* Ascherson & Graebner, Syn. Mitteleur. Fl. 406. 1900 (≡ *Poa* sect. *Stenopoa* Dumortier).

Gesammtart *Poa nemoralis* L. (Ascherson & Graebner, 1900: 407; species 12–14).

Poa sect. *Tichopoa* Ascherson & Graebner, Syn. Mitteleur. Fl. 419. 1900 (species 15). TYPE: *Poa compressa* L.

Hybrid (Ascherson & Graebner, 1900: 421; species 16).

(Unranked?) *Pachyneurae* Ascherson, Fl. Brand. I: 847. 1864. (Ascherson & Graebner, 1900: 422).

Poa sect. *Homalopoa* Dumortier, Observ. Gramin. Belg. 110, 113. 1823. (Ascherson & Graebner, 1900: 422; species 17–18).

Poa sect. *Pandemos* Ascherson & Graebner, Syn. Mitteleur. Fl. 425. 1900. Nom. superfl. as circumscribed.

Gesammtart *Poa trivialis* L. (Ascherson & Graebner, 1900: 425; species 19–20).

Poa pratensis L. (Ascherson & Graebner, 1900: 428, species 21) (in *P.* sect. *Pandemos*, but not in Gesammtart *Poa trivialis*).

Hybrid (Ascherson & Graebner, 1900: 434; species 22).

Poa sect. *Pseudofestuca* Ascherson & Graebner, Syn. Mitteleur. Fl. 434. 1900 (= *Bellardiochloa* Chiovenda). TYPE: *Poa violacea* Bellardi (= *B. variegata* (Lamarck) Kerguélen).

Poa subg. *Psilantha* (K. Koch) Boissier, Fl. Orient. 5: 599. 1883. *Poa* [unranked] *Psilantha* K. Koch, Linnaea 21: 405. 1848 (= *Eragrostis* Wolf). TYPE: *Poa collina* (Trinius) K. Koch (≡ *Eragrostis collina* Trinius).

Under each section with more than one species included, except *Homalopoa*, there is one "Gesammtart" species listed. The German word Gesammtart (spelled with one m today) means the whole, or in the broadest concept. I take this Gesammtart species to represent the authors' concerted effort to pin down the section name, and thus to be the automatic type. This argument is made stronger by the fact that the authors provided Greek names for their sections that are derived from the Latin Gesammtart species epithets. (Note: *Poa* sect. *Pseudofestuca* and *Poa* subg. *Psilantha* belong to other genera.)

Although the *Poa bulbosa* and *P. alpina* groups have been placed as subsections of *P.* sect. *Poa* (Tzvelev, 1974, 1976), subsections of *P.* sect. *Bolbophorum* (Jirásek, 1935a), or together in *P.* sect. *Bolbophorum* (Ascherson & Graebner, 1900; Edmondson, 1978), molecular data suggest they are more remotely related within *Poa*, neither belonging to section *Poa* (Soreng, 1990; see cpDNA groups in section D, below). Thus, it is necessary to establish the correct names for the sections to which these species complexes belong, and this depends on the typification of *P.* sect. *Bolbophorum.*

It may be argued that *Poa* sect. *Bolbophorum* is automatically typified by *P. bulbosa* (D. Nicolson, pers. comm.), or not (R. Korf, pers. comm.). If this is automatic, as I have argued above, then the subsequent lectotypification by Edmondson (1978), on *P. alpina*, is contrary to the Code (Greuter et al., 1994) and should be rejected. In this case a new sectional name is needed for the *Poa alpina* complex.

If one does not accept that *Poa* sect. *Bolbophorum* is automatically typified, then the lectotype of *P. alpina* stands. In this case the *Poa bulbosa* complex would need a new sectional name.

It appears that Lindman (1926) was the next author to employ an infrageneric classification of *Poa.* This 26-year gap in the usage of infragenera in *Poa* is problematic in that other authors may have picked up any of these or additional sectional names in the meantime. However, I have searched many publications and not yet found intervening applications. In Lindman's outline of *Poa* infrageneric taxa, although one of Ascherson and Graebner's names was accepted, *Bolbophorum* species were divided among *Arenariae* and *Alpinae.* The rank was not explicitly stated by Lindman, and no new infrageneric combinations were made. Hermann (1939: 456) called the *P. bulbosa* group s. str., "*Poa* sect. *Bulbopoa,*" but that name is invalid as it was published without Latin. As no other alternative sectional names are available for either taxon, I propose the following taxonomic treatment.

Poa sect. **Bolbophorum** Ascherson & Graebner, Syn. Mitteleur. Fl. 391. 1900. TYPE: *Poa bulbosa* L. [lectotypification on *P. alpina* L., by J. R. Edmondson (1978: 331) is rejected here as unnecessary and contrary to the original intent].

Synonyms: (see section D, below).

Densely caespitose perennials, without rhizomes;

internal sheaths at the base of shoots indurate, thickened, with accumulations of hemicellulose, bulbous; leaf blades thin, lax, tending to wither early in the season, with one lengthwise adaxial groove on either side of the central vascular bundle; lemmas strongly keeled, pubescent or glabrous, the callus with a single dorsal tuft of woolly hairs or glabrous; palea keels scabrous, sometimes pilose below; flowers perfect, anthers 1–2 mm long.

Species included: *Poa akmanii* Soreng, P. Hein & H. Scholz, *P. bulbosa* L., *P. bactriana* Roshevits, *P. cephalonica* H. Scholz, *P. densa* Troitsky, *P. eigii* Feinbrun, *P. pelasgis* H. Scholz, *P. perconcinna* J. R. Edmondson, *P. perligularis* H. Scholz, *P. pitardiana* H. Scholz, *P. pseudobulbosa* Bor, *P. sinaica* Steudel, *P. timoleontis* Heldrich ex Boissier, and *P. vvedenskyi* Drobow.

The species are mainly native to the Mediterranean Region, with a secondary center in the Irano-Turanian Region. *Poa bulbosa* is widely introduced. The species are generally early spring-flowering in the Mediterranean Region. Several comparative studies of leaf and root trans-sectional anatomy have been made that differentiate between *P.* sect. *Bolbophorum* and sect. *Alpinae* (Buschmann, 1942; Vukolov, 1928, 1929; Jirásek, 1935b).

Poa [subg. *Poa*] sect. **Alpinae** (Hegetschweiler ex Nyman) Soreng, comb. et stat. nov. Basionym: *Poa* [unranked] *Alpinae* Hegetschweiler [1838: 84, providing the description] ex Nyman, Consp. Fl. Eur., part 4, 835. 1882. TYPE: *Poa alpina* L.

Synonyms: (see section D, below).

Densely caespitose perennials, without rhizomes; branching intravaginal; sheaths strongly overlapping at the base, tending to persist for more than one season (not bulbous and thickened), those of the uppermost culm leaves closed over ca. ¼ the length; leaf blades flat or folded, strict, glabrous, with one lengthwise adaxial groove on either side of the central vascular bundle; lemmas pubescent, the callus generally glabrous; palea keels scabrous, sometimes villous in part; flowers perfect, the anthers 1.2–2 mm long.

Species included: *Poa alpina* L., *P. badensis* Haenke ex Willdenow, *P. ligulata* Boissier, *P. media* Schur, *P. pumila* Host, *P. molinerii* Balbis, *P. thessala* Boissier & Orphanides.

Although *P. alpina* is circumboreal in distribution, these are mainly mountain species of the Mediterranean Region, and mountainous European provinces of the Circumboreal Region.

D. Infrageneric Classification for *Poa* in North America North of Mexico

Following is an outline of infrageneric taxa for *Poa* in North America. References to V. L. Marsh refer to unpublished names used in his 1950 dissertation and in Marsh (1952). Chloroplast DNA groups correspond to clades resolved using restriction site data (Soreng, 1990):

(cpDNA group I)

Poa subg. **Arctopoa** (Grisebach) Probatova, Novosti Sist. Vyss. Rast. 8: 34. 1971. Basionym: *Glyceria* sect. *Arctopoa* Grisebach, in Ledebour, Fl. Ross. 4: 392. TYPE: *Poa glumeris* Trinius (= *P. eminens* J. Presl).

Poa sect. **Arctopoa** (Grisebach) Tzvelev, Arktich. Fl. SSSR 2: 121. 1964. Basionym: *Glyceria* sect. *Arctopoa* Grisebach, in Ledebour, Fl. Ross. 4: 392. TYPE: *Poa glumeris* Trinius (= *P. eminens* J. Presl).

Poa subg. **Poa**

Poa sect. **Sylvestres** V. L. Marsh ex Soreng, Novon 8: 188. 1998. TYPE: *Poa sylvestris* A. Gray.

(cpDNA group II)

Poa sect. **Alpinae** (Hegetschweiler ex Nyman) Soreng, Novon 8: 193. 1998. Basionym: *Poa* [unranked] *Alpinae* Hegetschweiler ex Nyman, Consp. Fl. Eur., part 4, 835. 1882. TYPE: *Poa alpina* L.

Synonyms:

Poa subsect. *Caespitosae* V. Jirásek, Věstn. Král Ceské. Společn. Nauk, Tř. Mat.-Přír. 2: 3. 1935. TYPE: *Poa alpina* L. (lectotype, designated by Tzvelev (1974: 25)).

Poa ser. *Alpinae* Roshevits, Fl. URSS 2: 411. 1934. TYPE: *Poa alpina* L.

Poa [unranked] *Subbulbosae* Fries ex Andersson, Pl. Scand. Gram. (Fasc. 2) 45. 1852. TYPE: *Poa alpina* L. (lectotype, selected here).

(cpDNA group III)

Poa sect. **Ochlopoa** Ascherson & Graebner, Syn. Mitteleur. Fl. 387. 1900. TYPE: *Poa annua* L.

Synonyms:

Poa [unranked] *Micranthela* K. Koch, Linnaea 21: 404. 1848. TYPE: *Poa annua* L. (lectotype, selected here).

Poa [unranked] *Annuae* Fries ex Andersson, Pl. Scand. Gram. 47. 1852. TYPE: *Poa annua* L.

(cpDNA group IV)

Poa sect. **Poa**. TYPE: *Poa pratensis* L.

Synonyms:

Poa [unranked] *Macranthela* K. Koch, Linnaea 21: 404. 1848. TYPE: *Poa pratensis* L. (lectotype, selected here).

Poa [unranked] *Stoloniferae* Fries ex Lange, Haandb. Danske Fl. 75. 1851. TYPE: *Poa pratensis* L. (lectotype, selected here).

Poa sect. *Cenisia* Ascherson & Graebner, Syn. Mitteleur. Fl. 404. 1900. TYPE: *Poa cenisia* Allioni.

Poa [unranked] *Glareosae* Hegetschweiler, Fl. Schweiz 86. 1838. TYPE: *Poa distichophylla* Gaudin (= *P. cenisia* Allioni) (lectotype, selected here; see section C, above). [The lectotype proposed by Keng (1959: 203) is rejected here because *Poa polycolea* Stapf was not among the original elements.]

Poa [unranked] *Pratenses* Hegetschweiler, Fl. Schweiz 81. 1838. Nom. superfl. TYPE: *Poa pratensis* L.

Poa sect. *Incanae* V. Jirásek, Věstn. Král Ceské. Společn. Nauk, Tř. Mat.-Přír. 2: 4. 1935. Nom. superfl. (included two previously published legitimate sections). TYPE: *Poa cenisia* Allioni (lectotype, selected here).

Poa sect. *Obsoletae* Rouy, Fl. France 14: 267. 1913. TYPE: *Poa pratensis* L. (lectotype, selected here).

Poa sect. *Nervosae* Rouy, Fl. France 14: 278. 1913. TYPE: *Poa cenisia* Allioni (lectotype, selected here).

Poa sect. *Spizopoa* Dumortier, Observ. Gramin. Belg. 110, 111. 1823. TYPE: *Poa pratensis* L. (lectotype, selected here).

Poa sect. **Homalopoa** Dumortier, Observ. Gramin. Belg. 110, 113. 1823. TYPE: *Poa chaixii* Villars (lectotype, designated by Hermann (1939: 457)).

Synonyms:

Poa [unranked] *Silvaticae* Hegetschweiler [1838: 80, providing the description] ex Nyman, Consp. Fl. Eur., part 4, 833. 1882. TYPE: *Poa silvatica* Chaix [non. Pollich] (≡ *P. chaixii* Villars).

Poa sect. *Diversipoa* V. Jirásek & Chrtek, Preslia 34: 65. 1962. TYPE: *Poa chapmanniana* Scribner.

Poa sect. **Dioicopoa** (E. Desvaux) Bentham, 1881: 125. Basionym: *Poa* [unranked] *Dioicopoa* E. Desvaux, Fl. Chil. 6: 413. 1853. *Poa* subg. *Dioicopoa* (E. Desvaux) J. R. Edmondson, J. Linn. Soc., Bot. 331. 1978. TYPE: *Poa chilensis* Trinius (= *P. denudata*) (lectotype, designated by Keng (1959: 163)).

Poa sect. **Madropoa** Soreng, Syst. Bot. 16: 512. 1991. TYPE: *Poa piperi* Hitchcock.

Poa subsect. **Epiles** Hitchcock ex Soreng, Syst. Bot. 16: 512, 513. 1991. *Poa* [unranked] *Epiles* Hitchcock, Man. Grasses U.S. 129. 1935. Nom. inval., description in English. TYPE: *Poa epilis* Scribner.

Poa subsect. **Madropoa** Soreng, Phytologia 71: 410. 1991. TYPE: *Poa piperi* Hitchcock.

(cpDNA group V)

Poa sect. **Pandemos** Ascherson & Graebner, Syn. Mitteleur. Fl. 425. 1900. TYPE: *Poa trivialis* L.

Synonyms:

Poa [unranked] *Hydrophilae* Hegetschweiler, Fl. Schweiz 81. 1838. TYPE: *Poa trivialis* L. (lectotype, selected here; see section C, above).

Poa [unranked] *Fasciculiferae* Fries ex Lange, Haandb. Danske Fl. 74. 1851. TYPE: *Poa trivialis* L. (lectotype, selected here).

Poa [unranked] *Neurantha* K. Koch, Linnaea 21: 405. 1848. TYPE: *Poa trivialis* L.

Poa sect. *Coenopoa* Hylander, Bot. Not. 3: 354. 1953. Nom. superfl. TYPE: *Poa trivialis* L.

Poa sect. **Abbreviatae** Nannfeldt ex Tzvelev, Novosti Sist. Vyssh. Rast. 11: 30. 1974. TYPE: *Poa abbreviata* R. Brown.

Poa sect. **Tichopoa** Ascherson & Graebner, Syn. Mitteleur. Fl. 419. 1900. TYPE: *Poa compressa* L.

Poa sect. **Oreinos** Ascherson & Graebner, Syn. Mitteleur. Fl. 400. 1900. TYPE: *Poa laxa* Haenke.

Poa sect. **Stenopoa** Dumortier, Observ. Gramin. Belg. 110, 112. 1823. TYPE: *Poa nemoralis* L. (lectotype, designated by Tzvelev (1972: 50)).

Synonyms:

Poa [unranked] *Nemorales* Hegetschweiler, Fl. Schweiz 83. 1838. TYPE: *Poa nemoralis* L.

Poa [unranked] *Caespitosae* Fries ex Lange, Haandb. Danske Fl. 51. 1851. TYPE: *Poa nemoralis* L. (lectotype, selected here).

Poa sect. *Glaucopoa* Ascherson & Graebner, Syn. Mitteleur. Fl. 405. 1900. TYPE: *Poa caesia* Smith.

Poa sect. *Hylopoa* Ascherson & Graebner, Syn. Mitteleur. Fl. 406. 1900. Nom. superfl. TYPE: *Poa nemoralis* L.

Poa sect. **Bolbophorum** Ascherson & Graeb-

ner, Syn. Mitteleur. Fl. 391. 1900. TYPE: *Poa bulbosa* L. [lectotypification on *P. alpina* L., by J. R. Edmondson (1978: 331), is rejected in section C, above].

Synonyms:

Poa [unranked] *Arenariae* Hegetschweiler, Fl. Schweiz 87. 1838. TYPE: *Poa bulbosa* L. (lectotype, selected here).

Poa subsect. *Bulbosae* V. Jirásek, Věstn. Král Ceské. Společn. Nauk, Tř. Mat.-Přír. 2: 3. 1935. TYPE: *Poa bulbosa* L.

Poa ser. *Bulbosae* Roshevits, Fl. URSS 2: 375. 1934. TYPE: *Poa bulbosa* L.

Poa sect. **Secundae** V. L. Marsh ex Soreng, Syst. Bot. 16: 511, 523. 1991. TYPE: *Poa secunda* J. Presl.

Poa subsect. **Halophytae** V. L. Marsh ex Soreng, Phytologia 71: 410. 1991. TYPE: *Poa unilateralis* Scribner.

Poa subsect. **Secundae** Soreng, Phytologia 71: 410. 1991. TYPE: *Poa secunda* J. Presl.

Synonyms:

Poa [unranked] *Nevadenses* Hitchcock, Man. Grasses U.S. 136. 1935. Nom. inval., description in English.

Poa [unranked] *Scabrellae* Hitchcock, Man. Grasses U.S. 134. 1935. Nom. inval., description in English.

E. Two New Species

Poa chambersii Soreng, sp. nov. TYPE: U.S.A. Oregon: W side of Cascade Mountains, 15 mi. SW of Oakridge, SE "Lane Co., Fairview Mountain, T. 23 S., R. 1 E., Sec. 11, 5900 ft, northwest side of the summit peak, . . . on steep open slope in pockets of soil on shelving rock. . . . Pistillate and staminate plants in separate clumps," 9 July 1993, *K. L. Chambers 5746* (holotype, US; isotypes, K, OSC, WTU). Figure 1.

A *Poa cusickii* subsp. *purpurascente* rhizomatibus praesentibus, laminis omnibus planis (non involutis) laevibus sine pilis adaxialibus, floribus sexualiter fungentibus, dioeciis (non apomicticto-pistillatis cum antheris omnibus vestigialibus), plantarum staminatarum floribus antheris 1.8–3.7 mm longis praeditis differt.

Dioecious or gynodioecious; perennial, rhizomatous, branching extravaginal; culms from sparse tufts, often decumbent at the base, old sheaths persisting at base, 10–50 cm tall, with 0–2 nodes exposed; leaf sheaths weakly keeled, those of the uppermost culm leaves closed ca. ⅓–⅞; ligules of uppermost culm leaves 0.5–2.0(–2.5) mm long, truncate to rounded, adaxially smooth; leaf blades 2.0–5.0 mm wide, moderately firm, flat or folded, those of the culm less than 8 cm long, the basal culm blades vestigial, the innovation blades flat, smooth and glabrous on both surfaces; panicle 2–9 cm long, loosely contracted, lanceolate to ovoid, erect, few-flowered (fewer than 30 spikelets), the branches 1–2 per node, ascending to little spreading, naked below, smooth or very sparsely scabrous, less than 3.5 cm long; spikelets with 2–7 florets, 6–12 mm long; glumes, 3-veined, 3.5–4.5 mm long, ⅗–⅘ the length of adjacent lemmas; callus sparsely webbed on at least some florets, infrequently all glabrous; lemmas 5–7 mm long, glabrous or villous on the keel and marginal veins over the lower ¼, 5–7-veined; palea keels very sparsely scabrous; rachillas glabrous or sparsely scabrous; flowers unisexual; anthers 1.8–3.7 mm long in males and less than 1 mm long and early abortive in females; caryopses ca. 2 mm long, laterally compressed, flat adaxially, weakly keeled abaxially, yellowish brown, glabrous, endosperm solid, hilum round, ca. 0.3 mm diam.; lodicules two, ca. 0.6 mm long, broadly lanceolate, with a lateral lobe, glabrous.

The Steens Mountain plants are gynodioecious (vs. dioecious), somewhat tufted (vs. forming loose turf), with culms 10–33 cm tall (vs. 15–50), nodes exposed 0–1 (vs. 1–2), sheaths closed ⅓–⅔ their length (vs. ½–⅞), panicles 2–7 cm long (vs. 4–9), lemma calluses rarely webbed (vs. usually with a sparse, short web on at least some florets). They appear to represent a gynodioecious and more alpine race of the same species.

Distribution. Rich subalpine slopes, west side of the Cascade Mountains and alpine slopes of the Steens Mountain in Oregon. The species is at best infrequent in occurrence and probably should be considered rare.

The new species is named in honor of Kenton L. Chambers, Oregon botanist, teacher (from whom I took agrostology), and collector of the type.

Poa chambersii is considered to be a member of the *P. nervosa* complex. It is similar to those species but has smooth branches and a more condensed inflorescence. The other species (see list under *P. arnowiae* in section E, below) are partially gynodioecious, or, in the case of *P. rhizomata* Hitchcock, subdioecious. In the Cascade Mountains, *P. chambersii* appears to be dioecious, with an equal number of plants with fertile stamens and without them, but more detailed study of seed development and sex-ratios in the field are needed to confirm this. Population samples collected by D. H. Mansfield

Figure 1. *Poa chambersii* Soreng, illustrated from an isotype collection (*K. L. Chambers 5746*, OSC). —A. Habit. —B. Spikelet. —C. Floret.

from the Steens Mountains yielded sex-ratios of 10 pistillate to 35 perfect-flowered individuals (*95-75a*), and 9 pistillate to 21 perfect-flowered individuals (*95-78a*), indicating gynodioecy occurs in that region.

The origin of the new species also requires additional study. The species was postulated to have been one of the parents of *Poa cusickii* Vasey subsp. *purpurascens* (Vasey) Soreng, with *P. cusickii* subsp. *epilis* (Scribner) W. A. Weber being the other (Soreng, 1986; discussed as a form of *P. rhizomata*). *Poa chambersii* is marginally distinct from *P. cusickii* subsp. *purpurascens* (Vasey) Soreng except that it is rhizomatous and sexually reproducing (producing staminate, hermaphroditic, and pistillate individuals, vs. strictly pistillate and apomictic) and has blades that are mainly flat and smooth (never involute and hairy above). Most material of *P. cusickii* subsp. *purpurascens* is caespitose, but some collections exhibit short lateral shoots, and a few clearly have rhizomes (e.g., Oregon: Marion Co., Breitenbush Lk., *Peck 18734* (WILLU)). Most of the latter plants, however, have innovation blades that are involute and hairy to scabrous adaxially on and between the veins, and all plants are pistillate (herbarium sample size = 132 distinct specimens). Considering the evidence of intermediacy between *P. chambersii* and *P. cusickii* s.l., it might seem preferable to treat the new taxon as a subspecies of *P. cusickii.* However, the postulated independent origins of these taxa, putatively in different sections, makes this solution unsuitable.

The new species has been confused in herbaria with *Poa rhizomata* (specifically the *Baker* collections, see paratypes below), but its ligules are shorter (0.5–2.5 mm vs. 2–8 mm), sheaths more closed (⅓–)½–⅞ (vs. ⅓–½), culm blades mostly flat, 2.0–5.0 mm wide, the longest less than 8 cm in length, the apex broadly acute and smooth (vs. folded, 2.0–2.5 mm wide, the longest usually over 10 cm in length, the apex narrowly acute and scabrous), floret pubescence sparser or absent, the lemma keel sometimes glabrous, the callus web sparse and short or absent, the panicles loosely contracted, ovoid, erect, branches smooth or very sparsely scabrous (vs. open, nodding, the branches moderately densely scabrous), functional anthers 1.8–3.7 mm long (vs. 2.5–4). The Steens Mountains populations approach *P. stebbinsii* Soreng, except that plants are rhizomatous (vs. caespitose), the ligules are shorter and milky white (vs. long and hyaline), and the blades are flat and short (vs. involute and elongate), and the panicles are smooth (vs. scabrous).

Paratypes. U.S.A. **Oregon:** Lane Co., Fairview Mountain, E slope, Calapooya Range, open rocky soil, 4 July 1948, *W. H. Baker 5545* (OSC ♀, ♂, WILLU ♀, US♀); Fairview Mountain, Bohemia District, 14 July 1940, *Baker 1898* (ID ♂), *Baker 1896* (ID ♂), *Baker 1897* (ID ♂), N slope, *Baker 1934,* (ID ♀), on top, *Baker 1888* (ID ♂); McKenzie Pass, 7 mi. W of summit of Cascade Mountains, 7 Aug. 1920, *M. E. Peck 9823* (WILLU ♀); White Branch, stream bank, T. 16 S., R. 7 ½ E. Sec. 12, 3370 ft., 26 July 1938, *L. E. Detling 3370* (ORE ♀); Harney Co., Steens Mountains, Kieger Rim, 8000 ft., 3 Aug. 1992, *D. H. Mansfield 92-254,* Little Blitzen Cirque, 8600 ft., 17 Aug. 1992, *92-666,* 8700 ft., 18 Aug. 1992, *92-807,* 8960 ft., 28 July 1992, *92-126,* Little Blitzen Cirque, 9000 ft., dry rocky benches, 21 Sep. 1995, *95-76a,* moist ground adjacent to receding snow banks *95-75a, 95-78a* (all CIC, see population sex ratios above).

Poa arnowiae Soreng, sp. nov. TYPE: U.S.A. Utah: Utah Co., Provo, 8000 ft., 3 July 1894, *M. E. Jones 5573* (holotype, US-914888 [with a fragment of the type of *P. curta* Rydberg, *Tweedy 13* (ex NY)]; isotypes, DAV, GH, NY, RSA-100264, UC-157763, US-278718, WTU). Figure 2.

A *Poa wheeleri* [typum *P. curtae* Rydbergii, non auctor, includente] paniculis internodiis basalibus (3.5) 4–9 (13) cm longis, ramis plerumque deflexis, laminis planis sine pilis adaxialibus, vaginis et ligulis non dense scabris, pilis retrorsis carentibus, plantis partialiter gynodioeciis, floribus aliquis vel omnibus hermaphroditis, infrequenter omnibus pistillatis differt.

Partially gynodioecious; perennial, short rhizomatous; culms loosely tufted or solitary, erect or decumbent, 15–80 cm tall; leaf sheath smooth to sparsely scabrous, glabrous, keeled, the margins of the uppermost culm leaves closed ½–$^{9}/_{10}$ their length; ligules 0.5–4 mm long, smooth or very sparsely scabrous abaxially, truncate to obtuse, the lower ones erose; culm leaf blades 2.5–6 mm wide, flat, smooth or sparsely scabrous adaxially and abaxially, glabrous, those of the uppermost culm leaves mostly 2.5–6 cm long; panicle (5–)12–22 cm long, open, sparse, longest lower internodes within a plant (3.5–)4–9(–13) cm long, the branches nearly glabrous to moderately scabrous, 2–3(–4) per node, some of the lower ones eventually reflexed; spikelets strongly compressed, with 2–6 florets, 5–9 mm long; glumes ¼–¾ the length of the lower lemma, the first glume 1–3-veined, the second 3-veined; callus glabrous; lemmas 3–6.5 mm long, glabrous, sparsely hirsutulous (infrequently the keel and marginal veins sparsely villous, but never pilose between the veins); palea keels scabrous; rachillas smooth, the distal internodes more than 1 mm long; flowers all perfect, or pistillate and perfect mixed within the same spikelet and inflorescence, or all pistillate, functional anthers (1.3–)2–3.6 mm long.

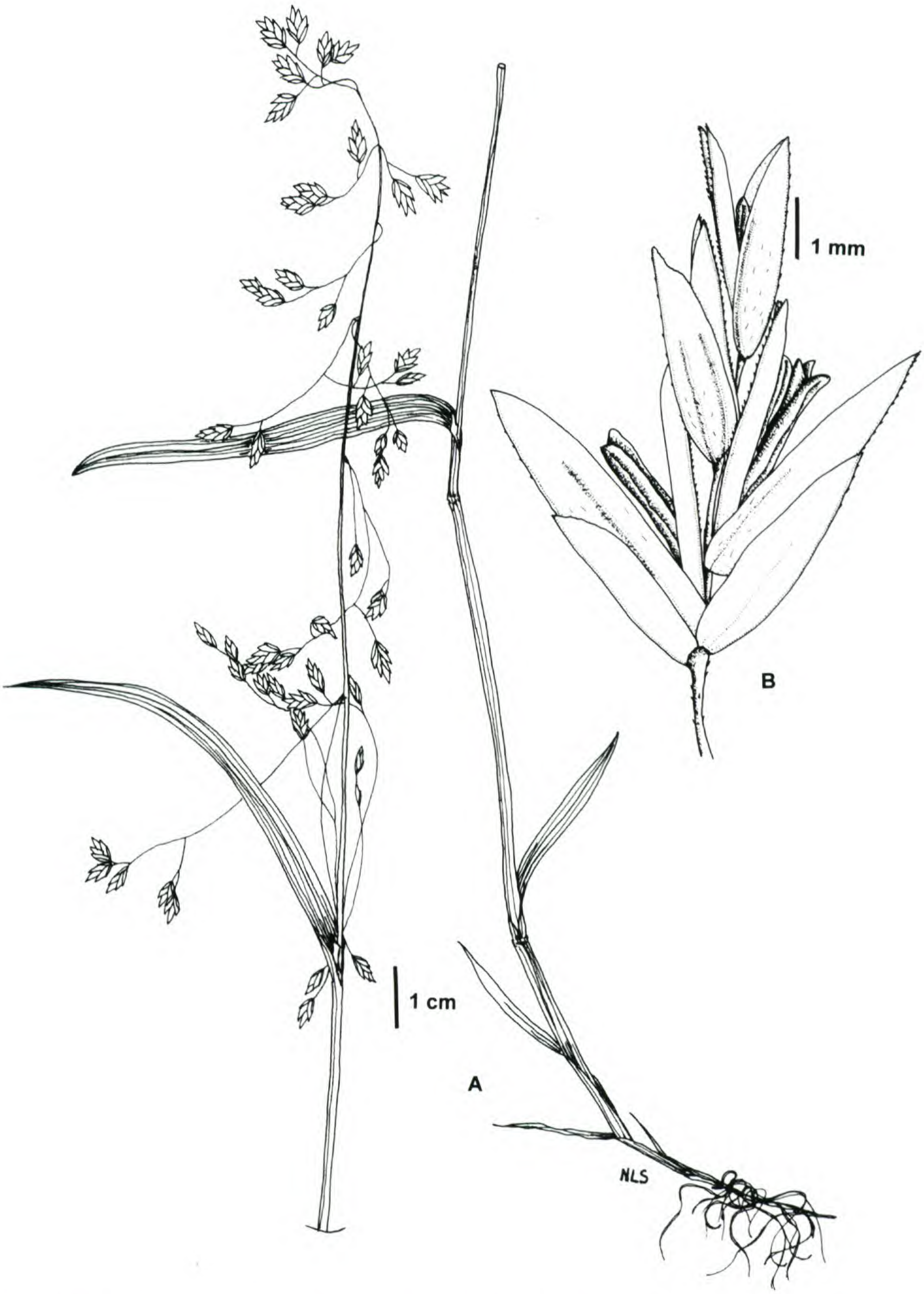


Figure 2. *Poa arnowiae* Soreng, illustrated from an isotype collection (*M. E. Jones 5573*, US-278718). —A. Habit. —B. Spikelet.

Distribution. Southeast Idaho, northern Utah, western Wyoming. Flowering late spring to mid summer. Shady slopes and margins of meadows, in rich soil, under oak, maple, aspen, and spruce/fir forests, from upper sagebrush to subalpine, 1500–3300 m.

The type specimen of *Poa curta* Rydberg (Wyoming: Teton Co., Spread Cr., 9800 ft. [2900 m], July 1897, *F. Tweedy 13* [holotype NY]) has uppermost culm sheaths 46% closed, lower culm sheaths moderately densely retrorsely pubescent, their ligules ca. 1 mm long and pubescent; panicles 5.2–6.3 cm

long, lowest internodes 1.2–2.1 cm long, branches mostly ascending, flexuous, less than 2 cm, moderately scabrous on the angles, peduncles 18–19 cm long; spikelets to 6 mm long; florets all pistillate, the lemmas more or less evenly and sparsely scabrous. It is fully within the range of characteristics of *P. wheeleri* Vasey.

In *Poa* sect. *Homalopoa,* in the *P. nervosa* complex, a new description is required for *Poa curta* sensu auctore, non Rydberg (Soreng, 1985). The new species honors Lois Arnow, Utah botanist, who came to the same conclusion independently that the type of *Poa curta* Rydberg belongs to *P. wheeleri* Vasey [*P. nervosa* var. *wheeleri* (Vasey) C. L. Hitchcock], and not to *P. curta* in the sense of other authors. She presented a detailed description (slightly narrowed here to eliminate what I consider to be characteristics of hybrid individuals) and discussed the need for a new name (Arnow, 1987: 764, 767). *Poa wheeleri* and the type of *P. curta,* unlike *P. arnowiae,* have a more densely tufted habit, retrorsely puberulent to scabrous sheaths and ligules, the sheaths often more open, innovation blades folded and hairy above, panicles with internodes mostly less than 4 cm long, the branches ascending or spreading (infrequently reflexed). *Poa wheeleri* produces seed apomictically and autonomously, normally producing only pistillate flowers. *Poa arnowiae* apparently is sexually reproducing and partially gynodioecious, usually producing pollen-bearing anthers, some plants with all flowers perfect and others bearing a mixture of perfect and pistillate flowers, infrequently all flowers on an inflorescence (or possibly a whole plant) pistillate. The two taxa apparently occasionally hybridize (Arnow, 1987; e.g., *L. Arnow 6122* [UT]), but for the most part are readily distinguishable.

Poa arnowiae belongs to a group of partially gynodioecious species, the *P. nervosa* complex. Other members of the complex are *P. cuspidata* Nuttall from the central Appalachian Mountains, *P. tracyi* Vasey from the Southern Rocky Mountain Front Ranges, and *P. nervosa* (Hooker) Vasey, *P. rhizomata* Hitchcock, and *P. chambersii* Soreng from west of the Cascade Mountains. There appears to be a close relationship between these species and *P. grandis* of China (see section B, above). *Poa wheeleri* is thought to have originated as a hybrid between some member of this complex and a species of section *Madropoa* Soreng, *P. cusickii* being the most likely candidate (Soreng, 1991a).

Paratypes. U.S.A. **Idaho:** Teton Co., Victor, damp shaded soil near a stream, 11 July 1901, *Merrill & Wilcox 213* (US). **Utah**: Wasatch Mountains, Manti Natl. Forest, Trinkler's Station, moist meadow, 8300 ft., 18 July 1908, *W. C. Clos 71a* (WIS). Cache Co., Pine Canyon, 5600 ft., 20 May 1932, *Burke 2887* (UTC); Bear River Range, West Hodges Pastures, 4 Aug. 1936, *Allen & Harris s.n.* (BH); vicinity of West Hodges Pasture, 8 June 1939, *Gessel & Killpack s.n.* (UTC); ridge S of High Cr., Lions Grove Camp Ground, 6 May 1966, *D. Hatch 127* (UTC); Spring Hollow, 8000 ft., 20 May 1934, *Maguire 13213* (BH, UTC); Spring Hollow, 7500 ft., 27 May 1939, *Maguire 16727* (UTC); Spring Hollow Trail, Mount Logan, 9000 ft., 25 May 1940, *Maguire 18605a* (UTC, NY); Tony Grove Canyon, 7000 ft., 26 May 1939, *Maguire 16704* (UTC); Cache Natl. Forest, Tony Grove, black loam, 6600 ft., 1 Aug. 1932, *Pickford & Pechanec 175* (US). Carbon Co., Scofield, 24 June 1904, *M. E. Jones 11149* (US); Eccles Canyon, ca. 4 mi. NW of Clear Cr., 8500 ft., 5 July 1979, *Welsh & Moore 18798* (BRY). Davis Co., head of Centerville Canyon, 8000 ft., 16 June 1936, *A. Hull* (US). Duchesne Co., Currant Cr., above dam, 1 June 1972, *Brotherson 1762* (BRY); Uintah Mountains, High country, at head of Blind Stream, rocky slope near summit of ridge, 10,500 ft., 3 July 1938, *Harrison & Nisson 8797* (US, mixed with *P. wheeleri*); Wolf Cr. Pass, among aspens, E slope of pass, 9000 ft., 16 June 1933, *E. H. Graham 8144* (US). Jaub Co., near spring, McCune Cr., Mount Nebo, 11 June 1937, *Bierisch 305* (UTC); Jaub or Salt Lake Co., Nebo Forest, 6000–8000 ft., 16 July 1913, *J. Barnett, U.S.F.S.# 116* (US). Lincoln Co., *Shultz & Shultz 2621* (NY). Salt Lake Co., Big Cottonwood Canyon, 7400 ft., 28 June 1983, *L. Arnow 6104* (UT); Big Cottonwood Canyon, 8600 ft., 6 Aug. 1983, *L. Arnow 6145* (NY, UT); Dry Cr. Canyon, 26 June 1983, *L. Arnow 6098* (UT); Mill Cr. Canyon, 8000 ft., 9 July 1983, *L. Arnow 6109* (UT); Alta, 20 Aug. 1883, *M. E. Jones* (RM, RSA); Wasatch Mountains near Salt-Lake City, 5000 ft., May 1869, *S. Watson 1316* (US); Big Cottonwood Canyon, below Silver Lk., 8 July 1905, *P. A. Rydberg 6778* (US). San Pete Co., *Lewis 4941* (NY); mountains E of Gunnison, 8500 ft., 28 June 1875, *L. F. Ward 296* (US 3 duplicates); Fairview Canyon, Skyline Rd., 8200 ft., 21 June 1977, *Clark 2556* (BRY). Silver Co., ridge NE of Musinia Ranger Station, 9000 ft., 29 June 1962, *Jeffery s.n.* (UTC). Utah Co., Mount Timpanogas, *Lewis 917* (NY); Provo, 1887, *S. M. Tracy 415* (US). Wasatch Co., *Brotherson & Blauer 44* (NY), *Blauer & Brotherson 73* (NY), *L. F. Ward 33, 296* (NY), *S. L. Hatch 1056* (CAN), *Lenard 186* (NY), *Maguire 17524* (NY), *Reiff s.n.* (NY); head of Wolf Cr., 9500 ft., 24 June 1926, *E. J. Adair 23* (US); Wolf Cr., 9000 ft., 6 June 1926, *E. J. Adair 10* (US); N of Wolf Cr. Summit, 13 Aug. 1980, *Soreng & Spellenberg 1358a & 1362b* (both NMC). Weber Co., Cache Valley Cr., 6500 ft., 14 June 1983, *L. Arnow 6095* (UT); Ogden, 7800 ft., 1 Aug. 1899, *L. H. Pammel s.n.* (US); Ogden, 1887, *S. M. Tracy 356* (US). **Wyoming:** Jackson Hole, Cache Cr., 23 July 1926, *A. S. Hitchcock 23118* (US; toward *P. wheeleri* in shorter inflorescences, to 11 cm long, and shorter inflorescence internodes, to 3.5 mm long, but with reflexed branches, nearly smooth sheaths, and looser habit).

F. New Names and Combinations in *Poa, Puccinellia,* and *Dissanthelium*

Poa unilateralis subsp. **pachypholis** (Piper) D. D. Keck ex Soreng, comb. et stat. nov. Basionym: *Poa pachypholis* Piper, Proc. Biol. Soc. Wash. 18: 146. 1905. TYPE: U.S.A. Washington: Pacific Co., Ilwaco, ocean bluffs, 22 June 1904, *C. V. Piper 4900* (holotype, US-556775; isotypes, US-3151666, US-748809, US-923750).

Lemma keels pilose for ½–¾ the length, marginal and lateral veins pilose for about ⅓ the length, the callus of some florets within spikelets with hairs 0.2–0.5 mm long distributed around the base. Chromosome number $2n = 42$.

Distribution. United States: Oregon (Newport, *Peck 1613E*), and Washington (Pacific Co., type locality).

Poa unilateralis subsp. *unilateralis* differs from subspecies *pachypholis* in that it has lemmas that are glabrous to ciliate on the margins, rarely sparsely pilose on the keel and marginal veins near the base, and glabrous between the veins, and also has calluses that are glabrous or infrequently with a minute crown of hair to 0.3 mm long. Its chromosome numbers are $2n = 42$, and 84. It has a more southerly distribution: United States: California (south to Monterey Co.) and Oregon (north to Tillamook Co., Netarts Bay).

Poa alpina L. × **Poa pratensis** L. s.l.

Poa ×gaspensis Fernald (pro sp.) Rhodora 31: 46. f. 1. TYPE: *Fernald & Collins 344* (holotype, GH; isotype, BH).

Perennial; culms from dense to loose tufts, erect or decumbent at the base, caespitose (rhizomatous or appearing rhizomatous in slumping soils), 15–50 cm tall; leaf sheaths of the uppermost culm leaves closed ¼–½, new shoots intra- and extravaginal, the old sheaths persisting; ligules 2–6 mm long, obtuse to acute; blades 1.5–3.5 mm wide, thin, flat; panicle 3–12 cm long, narrowly ovoid to lanceolate, erect, densely flowered, the branches 2–4 per node, ascending to spreading, flowered from above the middle, sparsely scabrous; spikelets with 3–4 florets, 3.5–6.0 mm long; glumes, the lower 3-veined, broadly lanceolate, sharply keeled, distinctly scabrous on the upper ⅓ of the keels; callus short webbed; lemmas 2.5–4.5 mm long, villous on the keel, lateral and marginal veins, puberulous between the veins; palea keels villous, glabrous between the keels; flowers perfect, anthers 1.2–1.4 mm long.

Distribution. Rocky or gravelly shores and slopes: Canada: Quebec (Gaspe Peninsula) south to Newfoundland (Labrador).

Poa ×gaspensis is a problematical taxon of suggested hybrid origin in the original publication (*P. alpina* × *P. alpigena*). It differs from *P. alpina* in its extravaginal branching and presence of a web; from *P. pratensis* in its acute ligules and more pubescent lemmas; from *P. arctica* in its sharply keeled and more scabrous glumes. It is quite variable in form, with traits appearing to segregate in various combinations toward the putative parents. It does produce seed as well as spread vegetatively. This would be the same hybrid combination as *Poa ×herjedalica* H. Smith, which has a suggested origin from *P. alpina* × *P. pratensis* s.l., but that taxon of northern Europe is strictly viviparous and more rhizomatous, and thus I hesitate to call it that.

Poa tovari Soreng, nom. nov. Replaced name: *Poa geniculata* Tovar, Publ. Mus. Hist. Nat. Lima, Ser. B. Bot. 32: 8. 1984; non *Poa geniculata* Durieu, Expl. Sci. Algerie 2: pl. 40, f. 4. 1849. TYPE: Peru. La Libertad: Prov. Contumaza, cerca Usquil, 3100 m, *E. Anderson 1265* (holotype, US-2012876; isotype, US-2012877).

The new name honors Óscar Tovar, Peruvian agrostologist, who originally described the species.

Puccinellia atacamensis (Parodi) Soreng, comb. nov. Basionym: *Poa atacamensis* Parodi, Revista Argent. Agron. 29: 18. 1963. Nom. nov. Replaced name: *Poa nana* Philippi, Anales Mus. Nac. Chile Bot. 8: 87. 1891; non *Poa nana* Savi, Ann. Bot. (Usteri) 24: 49. 1800. TYPE: Chile. Ad Machua in aquis cresit [Tarapaca], *Philippi* [*396*] (type, fragment US-88754).

This species belongs in *Puccinellia.* It has the generic diagnostic features of hard opaque caryopses with oval hila (somewhat larger than in *Poa*), short broadly obtuse glumes, papillae over much of the epidermis, and open culm sheaths.

Dissanthelium atropidiforme (Hackel) Soreng, comb. nov. Basionym: *Poa atropidiformis* Hackel, Svenska Exped. Magell. 3(5): 224. 1900. TYPE: Chile. [Isla Grande de Tierra del Fuego] Hab. Fuegia Orientalis, Rio Cullen, Paramo, [1896 or 1897], *Bruno Ansorge s.n.* (type, fragment US-89697).

Dissanthelium atropidiforme var. **patagonicum** (Parodi) Soreng, comb. nov. Basionym: *Dissanthelium patagonicum* Parodi, Physis (Buenos Aires) 8: 80. f. 7. 1925. *Poa atropidiformis* var. *patagonica* (Parodi) Nicora, Darwiniana 18: 97. 1973. TYPE: Argentina. Santa Cruz: [Rio Gallegos], 24 Dec. 1922, *L. Dauber 180* (holotype, BA; isotypes, SI, US-2947335).

Spikelets of *Poa atropidiformis* var. *patagonica* are barely distinguishable from *Dissanthelium californicum* (Nuttall) Bentham. The former is, how-

ever, a tufted perennial with sclerophyllous leaves, and the latter is a slender annual with soft lax leaves. *Poa atropidiformis* var. *atropidiformis* has glabrous lemmas but is otherwise indistinguishable from variety *patagonica.* I believe *P. atropidiformis* is closer to other species of *Dissanthelium* than to any in *Poa.* Although both species infrequently have a web on the dorsal side of the callus, like that in *Poa,* I have seen a web in other species of *Dissanthelium* as well. The leaf blades of *Dissanthelium* are also like those in *Poa* in having only two grooves on the adaxial surface. In addition, the caryopses of *Dissanthelium* are hard and translucent, and have a punctiform hilum, as in *Poa.* In view of these features, it seems likely that *Dissanthelium* is either a sister group to *Poa* or an offshoot of it, and that the characteristic of glumes longer than the lowermost floret is once again found to be homoplasious between Poeae and Aveneae. It should be noted that several species of *Poa* also have glumes that are longer than their adjacent florets as in *Dissanthelium.*

Dissanthelium calycinum subsp. **mathewsii** (Ball) Soreng, comb. et stat. nov. Basionym: *Deschampsia mathewsii* Ball, J. Linn. Soc., Bot. 22: 60. 1885. *Dissanthelium mathewsii* (Ball) R. C. Foster & L. B. Smith, Phytologia 12 (5): 249. 1965. TYPE: Peru. Above Caspalta, 14000–14300 ft., 22 Apr. 1882, *J. Ball s.n.* (holotype, K, fragment US-908709 ex K; isotype, GH not seen).

Dissanthelium sclerochloides Steudel ex E. Fournier, Mexic. Pl. 2: 112. 1886. TYPE: Mexico. Nevado de Toluca, 1865–1866, *M. Hahn s.n.* (lectotype selected here, P, fragment US; isolectotype, P). SYNTYPES: Mexico. San Luis Potosi, *Vierlet d'Aoust 1435* (P, fragment US ex P); Chile. *Lechler 1832* (P).

Having examined all the *Dissanthelium* material at US I found it apparent that *D. calycinum* and *D. mathewsii* (including *D. sclerochloides*) overlap in their diagnostic features. The Mexican plants (previously known as *D. sclerochloides*) extend slightly into the morphological range of *D. calycinum* as delimited by Swallen and Tovar (1965) and Tovar (1993), and the Peruvian plants overlap well into the morphological range of the Mexican plants. However, considered together, the plants clearly exhibit a bimodal pattern of variation. All the Mexican material is considered to be subspecies *mathewsii.* Both subspecies are present in the Andes, but there subspecies *calycina* is the more common. Of the three specimens available for lectotypification of *D. sclerochloides,* the *Hahn s.n.* collection with the binomial written in Fournier's hand (the script verified by A. Lourteig, pers. comm.) is selected for the lectotype. The second *Hahn s.n.* collection was not annotated by Fournier, and the *Vierlet d'Aoust 1435* collection, although annotated by Fournier, is scanty and is mixed with *Poa annua.*

Acknowledgments. I thank Dan Nicolson, Gerrit Davidse, and Dick Korf for discussions concerning application of the Botanical Code; Ken Chambers for collection of the type material of his new species, and Donald Mansfield for the new collections from Steens Mountain; Nancy Soreng for the illustrations; Bill Dress for assistance with the Latin; reviewers including Paul Peterson, Dan Nicolson, Hildemar Scholz, and anonymous for their constructive comments; Alicia Lourteig for comments on syntypes borrowed from P; and the curators of OSC, NY, P, and US, who have loaned specimens for this project.

Literature Cited

Anton, A. M. 1978. Notas críticas sobre gramíneas de Argentina III. Contribución al conocimiento de la sexualidad en *Poa.* Bol. Acad. Nac. Ci. [Cordoba, Argentina]. 52: 267–275

——— & H. E. Connor. 1995. Floral biology and reproduction in Poa (Poeae: Gramineae). Austral. J. Bot. 43: 577–599.

Arnow, L. 1987. Poaceae. Pp. 684–788 *in* S. L. Welsh et al., A Utah Flora. Great Basin Naturalist Mem. 9: 1–894.

Ascherson, P. F. A. & K. O. R. P. P. Graebner. 1990. Synopsis der Mitteleuropäischen Flora. Vol. 2, Part 1. Leipzig.

Beetle, A. A. 1955. The grass genus *Distichlis.* Revista Argent. Agron. 22: 86–94.

Bentham, G. 1881. Notes on Gramineae. J. Linn. Soc., Bot. 19: 14–134.

Buschmann, A. 1942. Zur Klärung des Formenkreises um *Poa badensis* Haenke. Oesterr. Bot. Z. 91(2/3): 6–130.

Clayton, W. D. & S. A. Renvoize. 1986. Genera Graminum, Grasses of the World. Kew Bull., Addit. Ser. 13.

Edmondson, J. R. 1975. Taxonomic Studies in the Genus *Poa* L. (Gramineae). Ph.D. Dissertation, University of Leicester.

———. 1978. Infrageneric taxa in European *Poa* L. J. Linn. Soc., Bot. 76: 329–334.

———. 1980. Poa. Pp. 159–167 *in* T. G. Tutin, V. H. Heywood, N. A. Burges, D. M. Moore, D. H. Valentine, S. M. Walters & D. A. Webb, Flora Europaea. Vol. 5. Cambridge Univ. Press. Cambridge.

Greuter, W., F. R. Barrie, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva, P. Trehane & J. McNeill. 1994. International Code of Botanical Nomenclature (Tokyo Code). Regnum Veg. 131.

Hackel, E. 1887[–1888]. Gramineae. Pp. 1–130 *in* H. G. A. Engler & K. A. E. Prantl, Die natürlichen Pflanzenfamilien. Teil II, Vol. 2. Leipzig.

Hegetschweiler-Bodmer, J. 1838. Die Flora der Schweiz. Part 1 *of* J. Hegetschweiler-Bodmer. 1840. Die Flora der Schweiz. Fr. Schulthess.

Hermann, F. 1939. Zur Abgrenzung der Gattung *Poa* und zur Gliederung ihrer europäischen Arten. Hercynia 1: 451–461.

Jirásek, V. 1934. The distribution of the species of the genus *Poa* in Czechoslovakia. Sborn. Českoslov. Akad. Zeměd. [Prague] [Bull. Int. Acad. Sci. Bohême] 9[?]: 1–9.

———. 1935a. Systematické rozčlenéni a klík k určování Československých lipnic (*Poa* L.) [The systematical division and the key to some species of Central-European Bluegrass (*Poa* L.)]. Věstn. Král Ceské. Společn. Nauk, Tř. Mat.-Přír. 2: 1–34.

———. 1935b. The contribution to the studies of the anatomic character of the section of the leaf blade by the genus *Poa* L. with special reference to *P. badensis* Haenke. Sborn. Českoslov. Akad. Zeměd. [Prague] [Bull. Int. Acad. Sci. Bohême] 10[?]: 1–10.

Keng Y. L. 1959. Gramineae. *In* Nánjīng Dàxùe Shēngwùxùe Xì, hé Zhōnggúo Kxúeyùan Zhíwù Yánjiu Sŭo, Zhongguo Zhuyào Zhíwú Túji̇an, [2nd title: Flora Illustrata Plantarum Primarum Sinicarum, Gramineae]. Science Press, Beijing.

Lindman, C. A. M. 1926. *Poa*. Pp. 198–213 *in* O. R. Holmberg, Hartmans Handbok i Skandinaviens Flora. Häft. 2. P. A. Norstedt & Söners, Stockholm.

Marsh, V. L. 1950. A taxonomic revision of the genus *Poa* of United States and Southern Canada. Ph.D. dissertaion, University of Washington, Seattle.

———. 1952. A taxonomic revision of the genus *Poa* of United States and southern Canada. Amer. Midl. Naturalist 47: 202–250.

Nannfeldt, J. A. 1935. Taxonomical and plant-geographical studies in the *Poa laxa* group. Sym. Bot. Upsal. 1(5): 1–113.

Nicora, E. G. 1978. Part 3, Gramineae. *In* M. N. Correa, Flora Patagónica. Colección Científica del INTA, Buenos Aires.

Nyman, C. F. 1882. Conspectus Flora Europaea, Part 4. Örebro Sueciae, Bohlinianae.

Parodi, L. R. 1950. Las gramíneas tóxicas para el ganado en la República Argentina. Revista Argent. Agron. 17: 163–229.

———. 1962. Gramíneas Argentinas nuevas o críticas, IV. Revista Argent. Agron. 29: 12–22.

Soreng, R. J. 1985. *Poa* L. in New Mexico, with a key to middle and southern Rocky Mountain species (Poaceae). Great Basin Naturalist 45: 395–422.

———. 1986. Distribution and Evolutionary Significance of Apomixis in Diclinous *Poa* of Western North America. Ph.D. Dissertation, New Mexico State University, Las Cruces.

———. 1990. Chloroplast-DNA phylogenetics and biogeography in a reticulating group: Study in *Poa* (Poaceae). Amer. J. Bot. 77: 1383–1400.

———. 1991a. Systematics of the "Epiles" group of *Poa* (Poaceae). Syst. Bot. 16: 507–528.

———. 1991b. Notes on new infraspecific taxa and hybrids in North American *Poa* (Poaceae). Phytologia 71: 390–413.

——— & S. L. Hatch. 1983. A comparison of *Poa tracyi* and *Poa occidentalis*. Sida 10: 123–141.

Stapf, O. 1896. *Poa*. Pp. 330–340 *in* J. D. Hooker, The Flora of British India, Vol. 7. Reeve, London.

Swallen, J. R. & Ó. Tovar. 1965. The grass genus *Dissanthelium*. Phytologia 11: 361–376.

Takhtajan, A. 1986. Floristic Regions of the World. Univ. California Press, Berkeley.

Torres, M. A. 1970. *Poa*. Pp. 102–125 *in* A. L. Cabrera, Flora de la Provincia de Buenos Aires, Buenos Aires.

Tovar, Ó. 1993. Las Gramíneas (Poaceae) del Perú. Ruizia 13: 1–480.

Tzvelev, N. N. 1972. Notes on the systematics of genus *Poa* L., species of the European part of the USSR. Novosti Sist. Vyssh. Rast. 9: 47–54

———. 1974. The genus *Poa* L. in USSR. Novosti Sist. Vyssh. Rast. 11: 24–41.

———. 1976. Zlaki SSSR. Nauka Publishers, Leningrad. [English translation: 1983. Grasses of the Soviet Union. Published for the Smithsonian Institution Libraries, and National Science Foundation, by Amerind Publishing, New Delhi.]

———. 1989. The system of grasses (Poaceae) and their evolution. Bot. Rev. 55: 141–203.

Vukolov, V. A. 1928. Comparative root anatomy of Czechoslovak species of bluegrass. Sborn. Českoslov. Akad. Zeměd. [Prague] 3: 264–287.

———. 1929. Comparative leaf anatomy of Czechoslovak species of bluegrass. Sborn. Českoslov. Akad. Zeměd. [Prague] 4: 417–451.

Watson, L. & M. J. Dallwitz. 1992. The Grass Genera of the World. C.A.B. International, Wallingford, U.K.

Some New Combinations in the Flora of Sikkim

R. C. Srivastava
Botanical Survey of India, Gangtok (Sikkim). Present address: Botanical Survey of India, Allahabad, 211002 India

ABSTRACT. Ten new combinations in the Flora of Sikkim are communicated.

For the preparation of a *Flora of Sikkim*, the following new combinations are necessary, based on study of the types at K and CAL, protologues, field observations in Sikkim, and the requirements of the *International Code of Botanical Nomenclature.*

1. **Calanthe alpina** Hooker f. var. **keshabii** (Lucksom) R. C. Srivastava, comb. et stat. nov. Basionym: *Calanthe keshabii* Lucksom, Ind. J. Forestry 15: 136. 1992.

2. **Erythrodes hirsuta** (Griffith) R. C. Srivastava, comb. nov. Basionym: *Goodyera hirsuta* Griffith, Not. Pl. Asiat. 2: 393. 1849. Ic.

3. **Carex alpina** var. **lehmanii** (Drejer) R. C. Srivastava, comb. et stat. nov. Basionym: *Carex lehmanii* Drejer, Symb. Caric. 13. t.2. 1844.

4. **Carex vesiculosa** var. **pallida** (Kuekenthal) R. C. Srivastava, comb. et stat. nov. Basionym: *Carex vesiculosa* var. *congesta* fo. *pallida* Kuekenthal, in Engler, Pflanzenr. 38: 238. 1894.

5. **Kobresia nepalensis** var. **stiebritziana** (Handel-Mazzetti) R. C. Srivastava, comb. et stat. nov. Basionym: *Kobresia stiebritziana* Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 57: 54. 1920.

6. **Juncus concinnus** D. Don var. **gracilicaulis** (A. Camus) R. C. Srivastava, comb. et stat. nov. Basionym: *Juncus gracilicaulis* A. Camus, in Lecomte, Not. Syst. 1: 279. 1910.

7. **Leontopodium jacotianum** Beauvois var. **haastioides** (Handel-Mazzetti) R. C. Srivastava, comb. et stat. nov. Basionym: *Leontopodium haastioides* Handel-Mazzetti, Beih. Bot. Centralb. 44(2): 84. 1927.

8. **Melastoma malabathricum** L. var. **normale** (D. Don) R. C. Srivastava, comb. et stat. nov. Basionym: *Melastoma normale* D. Don, Prodr. Fl. Nep. 220. 1825.

9. **Oxalis leucolepis** var **griffithii** (Edgeworth & Hooker f.) R. C. Srivastava, comb. et stat. nov. Basionym: *Oxalis griffithii* Edgeworth & Hooker f., Fl. Brit. India 1: 436. 1874.

10. **Salomonia edentula** (DC.) R. C. Srivastava, comb. nov. Basionym: *Polygala edentula* DC., Prodr. 1: 334. 1824.

Acknowledgments. The author is grateful to the Director, Botanical Survey of India, the Keeper, Royal Botanic Gardens, Kew, and the Keeper, Royal Botanic Garden, Edinburgh, for facilities, and to the Royal Society, London, and INSA, New Delhi, for sponsoring the author's visits to British herbaria. Thanks are also due to P. J. Cribb, D. Simpson, C. Jeffrey (K), and H. J. Noltie (E) for help during the author's visits to their herbaria.

Rotheca (Lamiaceae) Revived

D. A. Steane

Department of Plant Sciences, University of Oxford, South Parks Road, Oxford, OX1 3RB, England. Current address: Cooperative Research Centre for Temperate Hardwood Forestry, Department of Plant Science, University of Tasmania, G.P.O. Box 252-55, Hobart, Tasmania, 7001, Australia

D. J. Mabberley

Department of Plant Sciences, University of Oxford, South Parks Road, Oxford, OX1 3RB, England. Current address: Rijksherbarium, University of Leiden, Netherlands and Royal Botanic Gardens Sydney, Mrs. Macquaries Road, Sydney, N.S.W. 2000, Australia (address for correspondence)

ABSTRACT. *Clerodendrum* L. s.l. subg. *Cyclonema* (Hochstetter) Guerke plus *Clerodendrum* sect. *Konocalyx* Verdcourt (subg. *Clerodendrum* pro parte) are recognized as a distinct genus, for which the earliest name is *Rotheca* Rafinesque. The new combinations *Rotheca commiphoroides* (Verdcourt) Steane & Mabberley, *Rotheca makanjana* (H. Winkler) Steane & Mabberley, *Rotheca myricoides* (Hochstetter) Steane & Mabberley, *Rotheca incisa* (Klotzsch) Steane & Mabberley, *Rotheca sansibarensis* (Guerke) Steane & Mabberley, *Rotheca sansibarensis* subsp. *occidentalis* (Verdcourt) Steane & Mabberley, *Rotheca sansibarensis* subsp. *caesia* (Guerke) Steane & Mabberley, and *Rotheca serrata* (L.) Steane & Mabberley are made.

Steane et al. (1997) have shown that *Clerodendrum* L. s.l. (Lamiaceae s.l.), as recently understood, is polyphyletic and that a group centered on the African *C. myricoides* complex (subg. *Cyclonema* (Hochstetter) Thomas) should be excluded and recognized as a distinct genus, for which the earliest valid, and available, name is *Rotheca* Rafinesque. The genus also includes section *Konocalyx* Verdcourt (subg. *Clerodendrum* pro parte).

Chloroplast DNA (restriction site analysis; Steane et al., 1997) and nuclear ribosomal DNA internal transcribed spacers (ITS1 and ITS2 sequence analysis; Steane et al. in press) of *Rotheca* are distinct from those of *Clerodendrum* s. str. Morphologically the two genera may be distinguished as follows (we are greatly indebted to Philip D. Cantino, Ohio University, for amplifying this key):

1a. Flower bud markedly asymmetrical, corolla expanding abruptly on lower side only; anterior corolla lobe frequently much larger than the other four; anthers usually basifixed (occasionally approaching versatile); stigma lobes frequently unequal . . . . . *Rotheca*

1b. Flower bud symmetrical or, if asymmetrical, usually expanding abruptly on upper side due to resupination; anterior corolla lobe only slightly (if at all) larger than the others; anthers versatile; stigma lobes equal . . . . . *Clerodendrum*

Of the two species of *Rotheca* recognized by Rafinesque, *R. ternifolia* Rafinesque is here chosen as lectotype. Included under this binomial is the plant Rheede called Tsjerou-Theka (i.e., the Malayalam name, cheriya (= small) thekku (= teak) (Nicolson et al., 1988: 260)), Rafinesque's latinization of which is the basis for the generic name.

ROTHECA RAFINESQUE

Rotheca Rafinesque, Fl. Tellur. 4: 69. 1838. TYPE: *Rotheca ternifolia* Rafinesque = *Rotheca serrata* (L.) Steane & Mabberley (lectotype, selected here).

Spironema Hochstetter, Fl. Abyss. Exsicc. Unio Itin. i 1840 n. 330. ?1841, non Rafinesque (1838) nec Lindley (1840). Syn. nov. TYPE: *Spironema myricoides* Hochstetter = *Rotheca myricoides* (Hochstetter) Steane & Mabberley.

Cyclonema Hochstetter, Flora 25: 225. 1842, nomen novum pro *Sprionema* Hochstetter; *Clerodendrum* L. ["*Clerodendron*"] sect. *Cyclonema* (Hochstetter) Guerke, in Engl., Pflanzenw. Ost-Afrikas C: 341. 1895; *Clerodendrum* subg. *Cyclonema* (Hochstetter) Thomas, in Engl., Bot. Jahrb. Syst. 68: 22. 1936. TYPE: *Cyclonema myricoides* (Hochstetter) Hochstetter = *Rotheca myricoides* (Hochstetter) Steane & Mabberley.

Clerodendrum L. sect. *Konocalyx* Verdcourt, in Polhill, Fl. Trop. East Africa, Verbenaceae: 86. 1992. Syn. nov. TYPE: *Clerodendrum incisum* Klotzsch = *Rotheca incisa* (Klotzsch) Steane & Mabberley.

Shrubs, subshrubs or herbs, sometimes geoxylic, more rarely scandent or decumbent, or even small trees. Leaves opposite or verticillate, sessile or shortly petiolate, often distinctly crenate or coarsely serrate, but sometimes entire, distinctly acrid when crushed. Inflorescences terminal thyrses or axillary cymes, usually lax, occasionally reduced to solitary, axillary flowers. Flowers non-resupinate. Calyx campanulate to subspherical, frequently red or purple, not accrescent, (4)5(6)-lobed up to half its length, the lobes acute to rounded. Corolla predominantly blue to whitish, asymmetrical in bud (expanding abruptly on anterior side), sub-actinomorphic to unilabiate (all lobes on lower lip due to cleft between posterior lobes), tube curved or straight, often anteriorly saccate, lobes 5, anterior often much larger and colored differently from the other four. Stamens parallel, long-exserted, usually arched (straight in *R. incisa*), anthers usually basifixed, thecae parallel, not confluent. Ovary glabrous, glandular or hairy: placentas not furcate; stigma lobes frequently unequal. Fruit a 4-lobed drupe or drupaceous schizocarp, each lobe containing a 1-seeded pyrene.

Distribution. Widespread throughout sub-Saharan Africa, Madagascar, Indian Ocean islands, and tropical Asia, east to the Moluccas.

Although a full revision of *Rotheca* is not ready for publication, names are needed for a new edition of *The Plant-book* (Mabberley, 1997) and other publications and so the following new combinations are proposed here:

1. Rotheca commiphoroides (Verdcourt) Steane & Mabberley, comb. nov. Basionym: *Clerodendrum commiphoroides* Verdcourt, in Polhill, Fl. Trop. E. Africa, Verbenaceae: 139. 1992. TYPE: Tanzania. Iringa Dist., 55 km on Mafinga–Madibira Road, *Bidgood et al. 1297* (holotype, K; isotypes, not seen).

Tanzania

2. Rotheca incisa (Klotzsch) Steane & Mabberley, comb. nov. Basionym: *Clerodendrum incisum* Klotzsch, in Peters, Reise Mossamb., Bot. 1: 257. 1861. TYPE: Mozambique. Rios de Sena, Querimba & Boror, *Peters s.n.* (syntypes, B destroyed).

Tropical east Africa; widely cultivated in the tropics and under glass elsewhere.

3. Rotheca makanjana (H. Winkler) Steane & Mabberley, comb. nov. Basionym: *Clerodendrum makanjanum* H. Winkler, Feddes Repert. 18: 124. 1922. TYPE: Tanzania. S. Pare Mts., Makanja–Same, 1 Sep. 1910, *Winkler 3797* (holotype, BRSL lost). See Verdcourt (1992: 141) for discussion of the type.

Kenya, Tanzania

4. Rotheca myricoides (Hochstetter) Steane & Mabberley, comb. nov. Basionym: *Spironema myricoides* Hochstetter, Fl. Abyss. exsicc. Unio Itin., i 1840 n. 330. ?1841. *Cyclonema myricoides* (Hochstetter) Hochstetter, Flora 25: 226. 1842. *Clerodendrum myricoides* (Hochstetter) R. Brown [in Salt, Voy. Abyss., App.: lxv. 1814, nom. nud.] ex Vatke, Linnaea 43: 535. 1882. *Siphonanthus myricoides* (Hochstetter) Hiern, Cat. Afr. Pl. Welw. 1: 844. 1900. TYPE: Ethiopia. Mt. Scholoda, *Schimper 330* (holotype, TUB; isotypes, BM, K, OXF).

Central and east to northeast tropical Africa. *Rotheca myricoides* comprises a perplexing complex of morphological variants (see Verdcourt (1992) and Persson (1992) for discussion), of which 'Ugandensis' is widely cultivated (known as Oxford & Cambridge bush due to its dark blue and light blue corolla lobes); see Staples (1991).

5. Rotheca sansibarensis (Guerke) Steane & Mabberley, comb. nov. Basionym: *Clerodendrum sansibarense* Guerke, in Engl., Bot. Jahrb. Syst. 18: 181 (22 Dec. 1893). TYPE: Tanzania. Zanzibar, Tumbatu Is., Kokotoni, Aug. 1889, *Stuhlmann 511* (holotype, B destroyed; isotype, HBG (K, photo)).

Verdcourt (1992) recognized three subspecies: subspp. *sansibarensis*, *occidentalis*, and *caesia*.

(i) Rotheca sansibarensis subsp. **sansibarensis**

Kenya, Tanzania, Zambia, Zaire

(ii) Rotheca sansibarensis subsp. **occidentalis** (Verdcourt) Steane & Mabberley, comb. nov. Basionym: *Clerodendrum sansibarense* subsp. *occidentale* Verdcourt, in Polhill, Fl. Trop. E. Africa, Verbenaceae: 127. 1992. TYPE: Tanzania. Handeni Dist., Kabuku Forest, *Faulkner 4163* (holotype, K).

Tanzania

(iii) **Rotheca sansibarensis** subsp. **caesia** (Guerke) Steane & Mabberley, comb. nov. Basionym: *Clerodendrum caesium* Guerke, in Engl., Bot. Jahrb. 28: 300. 1900. *Clerodendrum sansibarense* subsp. *caesium* (Guerke) Verdcourt, in Polhill, Fl. Trop. E. Africa, Verbenaceae: 128. 1992. TYPE: Tanzania. Iringa Dist., Utschungwe Mts., Muhanga, 10 Feb. 1899, *Goetze 633* (holotype, B destroyed).
Tanzania

6. Rotheca serrata (L.) Steane & Mabberley, comb. nov. Basionym: *Volkameria serrata* L., Mant. 90. 1767. *Clerodendrum serratum* (L.) Moon, Cat. Pls. Ceylon: 46. 1824. *Rotheca ternifolia* Rafinesque, Fl. Tellur. 4: 69, nom. illeg. superfl. (*V. serrata* in syn.). *Cyclonema serratum* (L.) Hassk., Pl. Jav. Rar.: 489. 1848. TYPE: India. Anon. in Herb. Linn. 809/5 (lectotype, designated by Moldenke & Moldenke (1983: 417), LINN).

Clerodendrum macrophyllum Sims, in Curtis, Bot. Mag. 52: t. 2536. 1824. *Rotheca bicolor* Rafinesque, Fl. Tellur. 4: 69. 1838, hom. illeg., superfl. (*Clerodendrum macrophyllum* in syn.). TYPE: Bot. Mag. t. 2536. 1824, drawn from material cultivated by R. Barclay at Bury Hill, Surrey, England, grown from seed sent from Mauritius (probably sent by C. Telfair).

Indomalesia.

Acknowledgments. We are indebted to Phil Cantino and Charlie Jarvis for help over some points in this paper, prepared subsequent to DAS's thesis work, which was supported by the Rhodes Trust, Colin Trapnell Fund, Nancy Lindsay Trust, Percy Sladen Memorial Fund, and University College, Oxford, and was supervised by DJM, R. W. Scotland, and R. G. Olmstead.

Literature Cited

Mabberley, D. J. 1997. The Plant-book: A Portable Dictionary of the Vascular Plants, 2nd ed. Cambridge Univ. Press, Cambridge.

Moldenke, H. N. & A. L. Moldenke. 1983. Verbenaceae. *In:* M. D. Dassanayake (editor), A Revised Handbook to the Flora of Ceylon 4: 196–487. Amerind, New Delhi.

Nicolson, D. H., C. R. Suresh & K. S. Manilal. 1988. An interpretation of Van Rheede's Hortus Malabaricus. Regnum Veg. 119.

Persson, E. 1992. Taxonomic Studies in the *Clerodendrum myricoides* Group (Verbenaceae). Licentiat examination. Uppsala University (unpublished).

Staples, G. 1991. *Clerodendrum ugandense* as a cultivar of *C. myricoides.* Baileya 23: 166–167.

Steane, D. A., R. W. Scotland, D. J. Mabberley & R. G. Olmstead. In press. Molecular systematics of *Clerodendrum* (Lamiaceae): Its sequences and total evidence. Amer. J. Bot.

———, R. W. Scotland, D. J. Mabberley, S. J. Wagstaff, P. A. Reeves & R. G. Olmstead. 1997. Phylogenetic relationships of *Clerodendrum* s.l. (Lamiaceae) inferred from chloroplast DNA. Syst. Bot. 22: 229–243.

Verdcourt, B. 1992. *Clerodendrum.* Pp. 84–144 *in* R. M. Polhill, Flora of Tropical East Africa, Balkema, Rotterdam.

Croton yecorensis (Euphorbiaceae), a New Species from Northwestern Mexico

Victor W. Steinmann
Rancho Santa Ana Botanic Garden, 1500 North College Ave., Claremont, California 91711, U.S.A.

Richard S. Felger
Drylands Institute, 2509 North Campbell #405, Tucson, Arizona 85719, U.S.A.

ABSTRACT. *Croton yecorensis*, a new species in the section *Medea*, is described and illustrated. This species appears taxonomically isolated, and its exact affinities are not obvious. It is endemic to a narrow zone in the Sierra Madre Occidental of extreme east-central Sonora between the vicinities of Yécora and Mulatos.

RESUMEN. *Croton yecorensis*, una nueva especie en la sección *Medea*, es descrita e ilustrada. Esta especie parece ser taxonómicamente aislada y su afinidad no es obvia. Aparentemente es endémica en una zona del borde de la Sierra Madre Occidental, en el extremo Este-Centro de Sonora entre las vecindades de Yécora y Mulatos.

Croton is a large, subcosmopolitan assemblage of at least 800 species and is most diverse in tropical to warm temperate regions worldwide (Webster, 1993). We estimate that about 100 species occur in Mexico, including 14 in the state of Sonora. During our preparation of a treatment covering the Euphorbiaceae in Sonora (Steinmann & Felger, 1997), it became apparent that a number of collections of an unusual *Croton* did not correspond with any previously described species. These collections are here proposed as a new species.

Croton yecorensis V. W. Steinmann & Felger, sp. nov. TYPE: Mexico. Sonora: Municipio de Sahuaripa, 2 km SE of airfield, ca. 4 km SSW of Mulatos, 28°37′49.1″N, 108°45′38.2″W, ca. 1380 m, oak woodland, edge of meadow and small rock outcrop of volcanic rock, 14 Oct. 1994, *Felger & Búrquez 94-574* (holotype, ARIZ; isotypes, ASU, CAS, DAV, MEXU, MO, NY, RSA, SD, TEX, US, USON). Figure 1.

Frutex vel herba perennis 0.3–1.0 m alta; stipulae et bractae in lacinias glanduligeras dissectae; folia alterna, petioli 3–8 mm longi, laminae integrae, lineares vel anguste ellipticae, 3.2–7.1 cm longae, 0.4–0.9 cm latae, apice acuto, basi attenuata; margines foliorum et sepalorum pistillatorum glandulis stipitatis; inflorescentiae bisexuales; racemi terminales vel pseudoaxillares, floribus pistillatis 1–5, staminatis usque ad 42; florum staminatorum petala luteola, stamina 10–16; flores pistillati apetali; ovaria subglobosa, stellato-pilosa; styli 3, filiformes, bipartiti, 2.3–4.4 mm longi; capsula subglobosa, 5.0–5.6 mm longa, 4.7–5.6 mm lata; semina elliptico-oblonga, 3.8–4.4 mm longa, 2.6–2.8 mm lata, nitida, carunculata.

Monoecious, sparingly branched perennial herbs or subshrubs 0.3–1.0 m high, the branches mostly at acute angles and diverging dichotomously, stellate-tomentose nearly throughout, the rays of the stellae to 1.2 mm long; branchlets with a pale golden yellow to rust-brown cast; stipules divided into gland-tipped segments 0.5–4.1 mm long; leaves alternate, with petioles 3–8 mm long, lacking paired basal glands, pinnately veined, the midvein conspicuous, the secondary veins obscured by the indumentum, the lamina entire, linear to narrowly elliptic, 3.2–7.1 cm long, 0.4–0.9 cm wide, olive green, paler below, densely stellate-tomentose on both surfaces but more so beneath, attenuate at the base, acute at the apex, the margins often beset with stipitate glands reaching 0.7 mm long; inflorescences terminal or pseudoaxillary, bisexual, racemose, 2.5–4.8 cm long with 1–5 pistillate flowers at the base and 12–42 staminate flowers distally; bracts 1.4–3.1 mm long, divided into stipitate-glandular segments; staminate flowers on slender pedicels 1.8–3.4 mm long, calyx lobes 5, ovate, 1.7–2.1 mm long, petals 5, elliptic, 1.5–2.1 mm long, ca. 0.5 mm wide, cream yellow, villous at the base; receptacle villous; stamens 10–16, the filaments filiform, 1.5–2.0 mm long, villous at the base, the anthers elliptic, ca. 0.7 mm long, basifixed; pistillate flowers apetalous, subsessile or on stout pedicels to ca. 1.0 mm long, calyx lobes 5, valvate, lanceolate to linear-lanceolate, 3.4–6.6 mm long, acute, the margins beset with numerous stipitate glands 0.3–1.8 mm long; disk divided into glandular segments resembling the stipules; ovary subglobose, stellate-pilose; styles 3, filiform, rust-

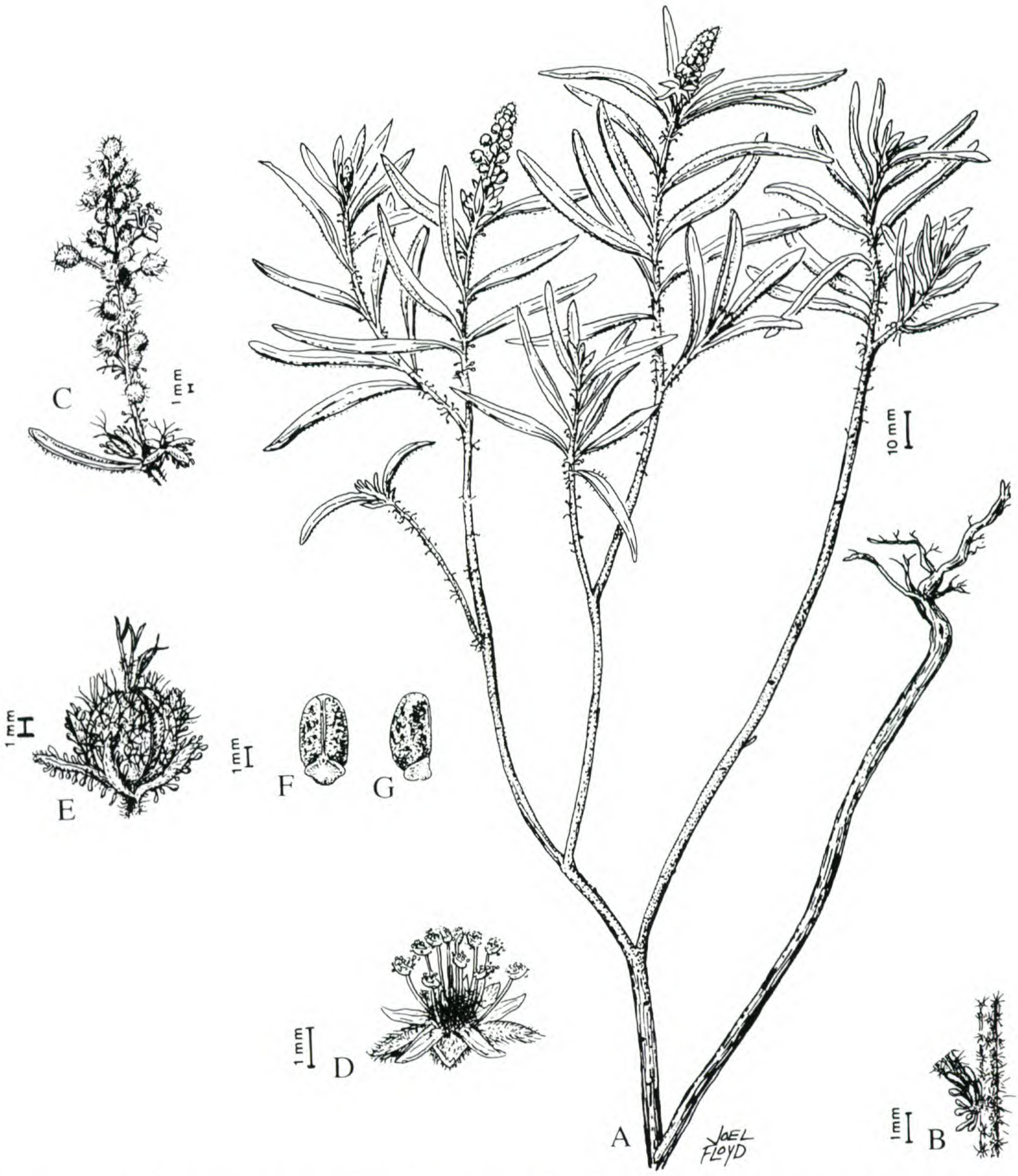


Figure 1. *Croton yecorensis* V. W. Steinmann & Felger.—A. Habit.—B. Node showing stipules and petiole base.—C. Inflorescence.—D. Staminate flower.—E. Capsule.—F. Seed, ventral view.—G. Seed, lateral view. All from *Felger & Búrquez 94-574.*

brown and with numerous stellate trichomes, 2.3–4.4 mm long, united at the base and biparted ½ to ⅘ their length; capsule subglobose, 5.0–5.6 mm long, 4.7–5.6 mm wide; seeds elliptic-oblong, 3.8–4.4 mm long, 2.6–2.8 mm wide, shiny, brown to mottled gray-blackish, with a fleshy, cream-yellow, reniform caruncle 0.6–0.7 mm long, 1.3–1.8 mm wide.

Distribution. *Croton yecorensis* is locally common in open, rocky, and grassy areas among oak and pine-oak woodland within the northern reaches of the Madrean floristic district of the Sierra Madre Occidental at elevations of 1260–1700 m. The collections are all within 60 km of each other in east-central Sonora near the Chihuahua border. The region is drained by the southeastern tributaries of

the Río Yaqui and perhaps also by the uppermost tributaries of the Río Mayo.

Phenology. Flowering and fruiting overlap broadly, and reproductive plants have been collected in February and from May to September.

Discussion. The exact relationship of *Croton yecorensis* to other species of *Croton* is not obvious. According to Grady Webster (pers. comm. 1997), it appears to be an anomalous member of section *Medea* (Klotzsch) Baillon. This section contains about 30 other species, all of which are restricted to South America (Webster, 1993). *Croton yecorensis* is readily distinguished from these species by its bifid (vs. multifid) styles.

Two collections (*Wilson 96-235* and *96-236*, both at ARIZ) from the Sierra de Cacaria in Durango, Mexico, superficially resemble *C. yecorensis* but differ in possessing a partially lepidote indumentum and in lacking conspicuous stipitate glands, although minute stipitate glands can sometimes be present on the bracts. Apparently these two collections represent another undescribed species possibly related to *C. yecorensis*.

Paratypes. MEXICO. **Sonora:** Municipio de Yécora, Río Maycoba drainage, Rancho La Pinosa, 10 km W of Río Maycoba bridge on Mexico Highway 16 and ca. 1.5 km N of highway, 28°24′46.6″N, 108°43′23.7″W, 1600 m, limestone-like rocky hills and flats with pine-oak and juniper woodland, open area, 4 July 1994, *Felger et al. 94-237* (ARIZ, CAS, DAV, MEXU, MO, NY, TEX), 8 July 1994, *Felger et al. 94-331* (ARIZ, DAV, MEXU, RSA); Yécora, on old road to Maycoba, 0.5 mi. E of Arroyo Yécora, 28°23.5′N, 108°54.5′W, 1550 m, open pine-oak forest, 7 Sep. 1995, *Fishbein 2473* (ARIZ, MEXU, RSA, USON); 7 mi. W of Yécora, 5600 ft., pine-oak woodland, 5 June 1976, *Goldberg 76-183* (ARIZ); 4.1 km (by road) NW of Yécora along the "old road" to Santa Ana/La Trinidad, 28°23′41″N, 108°56′02″W, ca. 1600 m, open oak-juniper woodland, 5 Sep. 1996, *Steinmann 1017* (ARIZ, IBUG, MEXU, MICH, NY, RSA); Los Pilares, Arroyo los Pilares, ca. 23 km E of Yécora, 26 km W of Maycoba on Mexico Highway 16, 28°22′00″–23′30″N, 108°47′30″W, 1260–1300 m, 6 May 1995, *Van Devender 95-469* (ARIZ, RSA, USON); ca. 7.5 km E of Yécora, 28°23′23″N, 108°52′23″W, 1620 m, pine-oak forest on rocky slope, 19 Feb. 1997, *Van Devender 97-144* (ARIZ, RSA, MEXU); Cerro La Pirinola, ca. 8.5 road km NW of Yécora on the "old road" to Santa Rosa/La Trinidad, 28°25′40″N, 108°58′25″W, 1690 m, apparently calcareous, dry rocky hills and flats with light grass cover and scattered *Arctostaphylos*, *Quercus*, *Juniperus*, and *Dasylirion*, shallow, gravelly soils in open areas, 4 Sep. 1995, *Wilson 95-100* (ARIZ), 30 June 1995, *Salywon 95-10* (ARIZ, ASU, CAS, MEXU, RSA, TEX, UC).

Acknowledgments. We thank Alberto Búrquez, George Ferguson, Mark Fishbein, Ana Lilia Reina-Guerrero, Shelley McMahon, Thomas Van Devender, and Michael Wilson for collaboration with fieldwork. Phil Jenkins, Kristen Johnson, and Lucinda McDade facilitated herbarium work at ARIZ. Joel Floyd prepared the illustration, and Ana Lilia Reina-Guerrero translated the resumen. Gordon McPherson and Grady Webster provided many useful comments concerning the manuscript. Felger's work was supported in part by the Wallace Research Foundation.

Literature Cited

Steinmann, V. W. & R. S. Felger. 1997. The Euphorbiaceae of Sonora, Mexico. Aliso 16: 1–71.

Webster, G. L. 1993. A provisional synopsis of the sections of the genus *Croton* (Euphorbiaceae). Taxon 42: 793–823.

Nanarepenta juxtlahuacensis (Dioscoreaceae), una Nueva Especie de Oaxaca, México

Oswaldo Téllez-Valdés y Patricia Dávila-Aranda
Departamento de Botánica, Instituto de Biología UNAM, Apartado Postal 70-367, 04510 México, D.F., Mexico

RESUMEN. Se describe *Nanarepenta juxtlahuacensis*, una nueva especie de Oaxaca, México. Se discuten sus relaciones con la especie más cercana, y su hábito y caracteres diagnósticos son ilustrados. Esta nueva especie está cercanamente relacionada con *N. guerrerensis* Matuda, de la que se distingue, porque las inflorescencias pistiladas son mucho más cortas que las hojas, las cápsulas oblongas y lisas, y los granos de polen son tectado-perforados, punteados.

ABSTRACT. A new species, *Nanarepenta juxtlahuacensis*, from the state of Oaxaca, Mexico, is described. Its habit and diagnostic characters are illustrated, and its relationships are discussed. This species is closely related to *N. guerrerensis*. It is distinguished from that species by having pistillate inflorescences shorter than the leaves, oblong and smooth capsules, as well as by having tectate-perforate and punctuate pollen grains.

Nanarepenta ha sido uno de los géneros taxonómicamente inciertos de la familia Dioscoreaceae (además de *Borderea*, *Epipetrum* e *Hyperocarpa*), motivo por el cual está siendo objeto de un profundo estudio sistemático (Téllez & Dávila, tesis doctoral, UNAM, en prep.). Como parte de este género han sido descritas dos especies, la primera *N. tolucana* Matuda (Matuda, 1961), que actualmente se considera como sinónimo de *D. multinervis* Bentham (Schubert, 1989) y la segunda *N. guerrerensis* Matuda en 1974, y que es la única reconocida en *Nanarepenta* hasta el momento. Sin embargo, existen 3 especies en la flora mexicana ubicadas en *Dioscorea*, que de acuerdo con nuestros estudios deben formar parte del género *Nanarepenta*, estas especies son: *Dioscorea mcvaughii* B. G. Schubert (= *N. mcvaughii* O. Téllez & Davila, ined.), *D. minima* B. L. Robinson & Seaton (= *N. minima* (B. L. Robinson & Seaton) O. Téllez & Davila, ined.) y la ya anotada *D. multinervis*. Como resultado se reconocen cinco especies para el género *Nanarepenta*, sin embargo, las combinaciones pertinentes no han sido publicadas hasta este momento. Una de las cinco especies señaladas, se descubrió durante el desarrollo de este proyecto, la cual ha sido estudiada detalladamente, y se describe a continuación:

Nanarepenta juxtlahuacensis O. Téllez & P. Dávila, sp. nov. TIPO: Mexico. Oaxaca: Dto. Santiago Juxtlahuaca, Mpio. San Sebastian Tecomoxtlahuaca, Cerro El Calvario, 500 m de San Sebastián Tecomoxtlahuaca, 17°21′08″N, 98°01′55″W, bosque de *Juniperus* con *Quercus*, alt. 1665 m, 3 sep. 1995, *Ismael Calzada 20214* (holótipo, MEXU; isótipos, ENCB, MICH, MO, MSU). Figura 1.

Herba prostrata vel volubilis, sinistrorsum. Folia 1.0–3.0 cm longa, 1.0–4.0 cm lata, (5–)7–9-nervata. Inflorescentiae staminatae 5.0–10.0 cm usque longae. Flores virides, subsessiles, (1–)2–4 in cymulis; stamina 3, basi tepalorum inserta; antherae extrorsae; pistillodia nulla. Inflorescentiae pistillatae racemosae 1.0–1.5 cm longae. Flores virides, subsessiles, solitarii; staminodia 3. Capsula 1.0–1.2 cm longa, 0.4–0.6 cm lata, oblonga, subcarnosa; semina 1.5–2.0 mm longa, 1.0–1.2 mm lata, rhombica vel ellipsoidea, brunea-rubra, non alata.

Rizoma de 1.0–5.0 cm en diámetro, elipsoidal, semiplano, corteza castaño claro, internamente blanco. Tallos sinistrorsos, lineados. Herbácea postrada a ligeramente voluble 10.0–60.0 cm largo; hojas 1.0–3.0 cm de largo, 1.0–4.0 cm de ancho, tornándose oscuras a negras con el secado, ovado-cordadas, base cordada, seno basal ampliamente campanulado, ápice agudo a acuminado; (5–)7–9-nervadas, nervaduras del envés marcadamente dentado-serruladas o papiladas. Inflorescencias estaminadas de 5.0–10.0 cm de largo, axilares; brácteas 0.2 mm de largo, linear-lanceoladas a lanceoladas, acuminadas; pedicelos 0.5 mm de largo, flores (1–)2–4 arregladas en címulas; perianto verdoso; tépalos 1.0–1.5 mm de largo, ca. 0.5 mm de ancho, oblongos a oblongo-lanceolados, en dos series una externa y otra interna; estambres 3, 0.5–0.8 mm, insertados entre la base de los tépalos de la serie externa y el toro, anteras coherentes, extrorsas; pistilodio ausente. Inflorescencias pistiladas racimos muy cortos 1.0–1.5 cm de largo; brácteas ca. 2 mm de largo, linear-lanceoladas a lanceoladas, acumi-

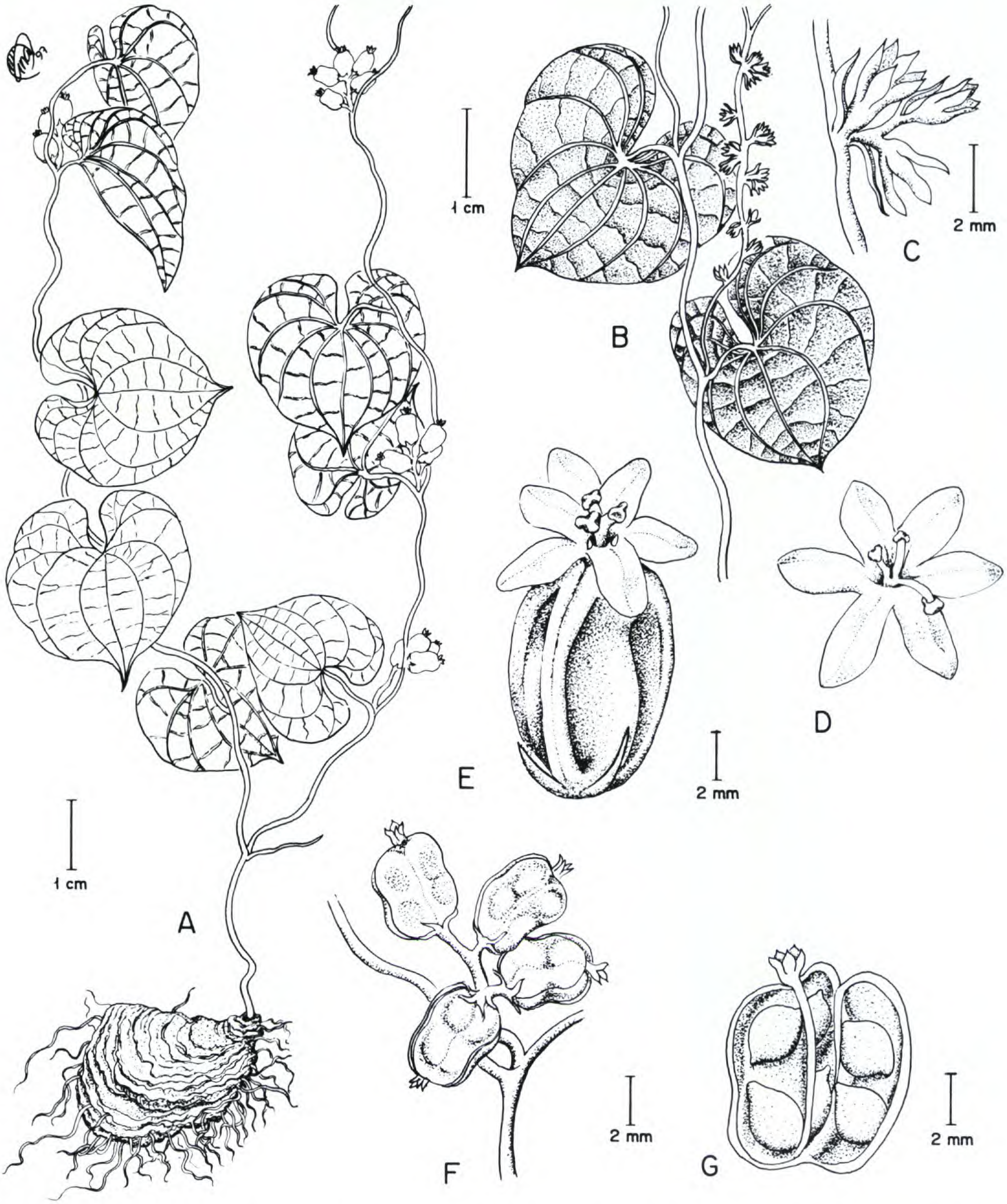


Figura 1. *Nanarepenta juxtlahuacensis* O. Téllez & P. Dávila. —A. Hábito de la planta pistilada, mostrando infrutescencias y rizoma. —B. Porción de la planta estaminada mostrando la disposición de las inflorescencias. —C. Detalle de una címula estaminada. —D. Detalle de una flor estaminada, mostrando los estambres. —E. Detalle de una flor pistilada y ovario fecundado, mostrando la columna estilar y los estaminodios, así como generalidades de las brácteas. —F. Infrutescencia mostrando la disposición de los frutos. —G. Frutos inmaduros, mostrando el número y la posición de las semillas (tomado de *Calzada 20214*).

nadas; perianto verdoso, tépalos 1.0–1.5 mm de largo, ca. 0.5 mm de ancho, oblongos a oblongo-lanceolados, en dos series una externa y otra interna; estaminodios 3, ca. 0.2–0.3 mm, triangulares; columna estilar ca. 0.5–0.7 mm de alto, estilos 3, bífidos. Cápsulas 1.0–1.2 cm de largo, 0.4–0.6 cm de ancho, oblongas, ligeramente carnosas, lisas, base y ápice redondeados; semillas 2 por lóculo, 1.5–2.0 mm de largo, 1.0–1.2 mm de ancho, 0.5-1.0 mm de grosor, rómbicas a elipsoides, castaño rojizo, no

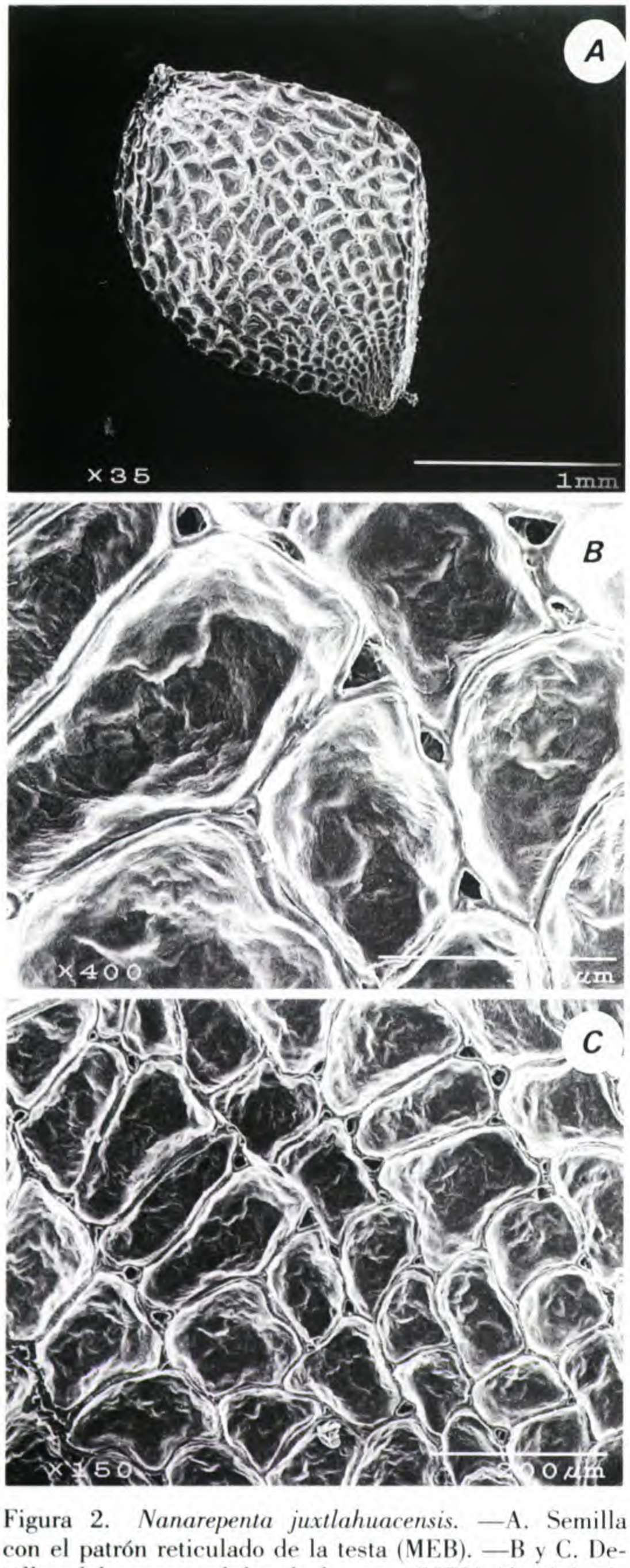


Figura 2. *Nanarepenta juxtlahuacensis*. —A. Semilla con el patrón reticulado de la testa (MEB). —B y C. Detalles del patrón celular de la testa (MEB) (de *Calzada 20214*).

aladas, la testa geométricamente ornada, las células subcuadradas, rómbicas a triangulares en general, formando un patrón reticulado.

Nanarepenta juxtlahuacensis está cercanamente relacionada con *N. guerrerensis* Matuda con la que comparte ciertos atributos morfológicos, como la dirección de trepado de los tallos, hábito más bien semivoluble, en contraste con las restantes tres especies de este género que son totalmente postradas, la forma muy semejante de la semilla y las características de la testa como son: un retículo primario con un patrón irregular, los campos abiertos; paredes sencillas, delgadas, con las paredes anticlinales rectas a curvadas o en ocasiones ligeramente onduladas. Las células pueden ser cuadradas, subcuadradas, semicirculares, triangulares y en raras ocasiones amorfas. Sin embargo, ambas especies se diferencian claramente ya que *Nanarepenta juxtlahuacensis* se caracteriza por presentar inflorescencias pistiladas más cortas que las hojas, cápsulas oblongas y lisas, y polen tectado-perforado, punteado. En adición, ocupan localidades cercanas entre si por menos de 200 km, considerándose que pueden representar especies muy cercanas por el conjunto de caracteres compartidos y habitar comunidades muy similares. En contraste, *N. guerrerensis* presenta inflorescencias pistiladas conspicuamente más largas que las hojas, cápsulas subesféricas y fuertemente verrugosas, y polen subtectado, microreticulado.

Distribución. *Nanarepenta juxtlahuacensis* es endémica del estado de Oaxaca; tiene un intervalo de distribución muy estrecho. Solamente se encuentra en pocas localidades del distrito de Juxtlahuaca en la Sierra Madre del Sur, en donde habita en bosques templados de *Quercus*, en ecotonos con matorrales xerófilos, a una elevación entre 1500–1665 m. Florece y fructifica entre julio y octubre.

Parátipos. MEXICO. **Oaxaca:** Distrito de Santiago Juxtlahuaca, Mpio. San Juan Mixtepec, Cañada San Isidro, 15 km al SO de San Juan Mixtepec, bosque de *Pinus-Quercus*, en suelos superficiales, 25 julio 1989, *J. Reyes 1848* (MEXU); sendero para el tanque de agua de San Miguel Tlacotepec, 17°27′24″N, 97°59′10″W, ecotono de bosque de *Juniperus flaccida* con *Quercus* con palmar de *Brahea dulcis*, suelo negro, mucha roca caliza, alt. 1635 m, 2 sep. 1995, *I. Calzada 20197* (MEXU); Mpio. San Miguel Tlacotepec, sendero para el tanque de agua de San Miguel Tlacotepec, 17°27′24″N, 97°59′09″W, ecotono de bosque de *Quercus* y bosque tropical caducifolio, con *Juniperus, Brahea, Dodonea viscosa, Cnidoscolus, Ipomoea, Dalea*, suelo arcilloso con afloramiento de roca calcárea, alt. 1500 m, 21 ago. 1996, *G. Flores F. & I. J. Calzada 4680* (MEXU).

Micromorfología de las Semillas

A continuación se describen las características en esta especie. Debido a que no existen estudios de las semillas de esta familia, se seleccionaron diversos términos para lograr la descripción de los caracteres en este grupo, siguiendo los trabajos de Gunn y Seldin (1976), Maas y Rübsamen (1986), Maas y Ruyters (1986) y Maas et al. (1986).

Semillas rómbicas a elipsoides, 1.5–2.0 mm de largo, 1.0–1.2 mm de ancho, 0.5–1.0 mm de grosor;

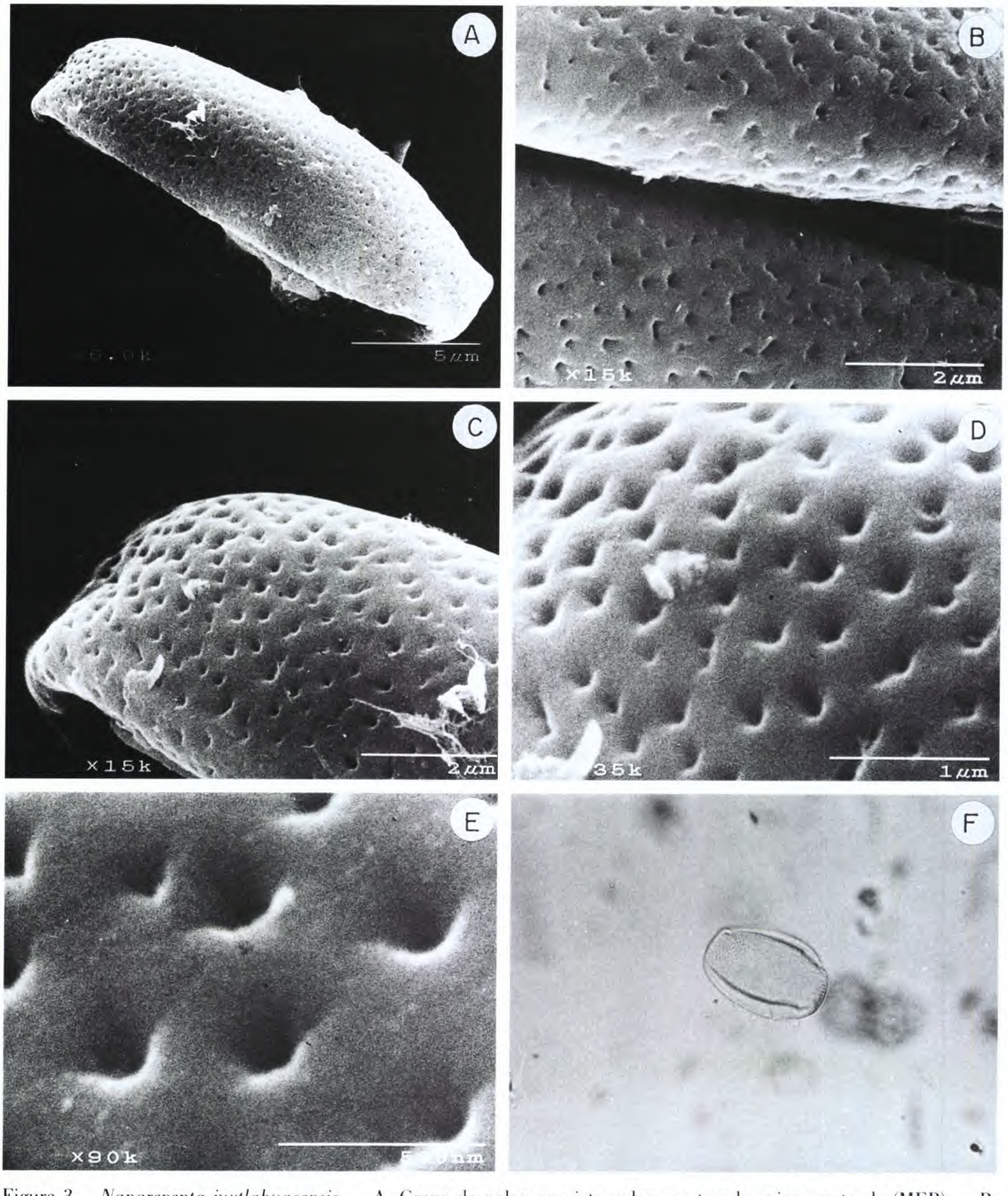


Figura 3. *Nanarepenta juxtlahuacensis*. —A. Grano de polen en vista polar, mostrando exina punteada (MEB). —B. Vista del colpo (MEB). —C–E. Vistas de la exina mostrando lúmenes y muros a diferentes ampliaciones (MEB). —F. Granos de polen visto al microscopio óptico, mostrando el "patron" microreticulado de la exina (1000×) (de *Calzada 20214*).

testa reticular, con reticulo sólo primario, con patrón irregular, y campos abiertos; paredes sencillas, grosor delgado, paredes anticlinales variadas, de rectas, curvadas hasta ligeramente onduladas. Celulas de variada formas (cortamente rectangulares, cuadradas, subcuadradas, semicirculares, triangulares y en ocasiones amorfas), con disposición irregular, de (0.09–)0.13–0.21 mm de largo, de 0.05–0.14 mm de ancho en general, disminuyendo en tamaño hacia los extremos (polos) (Figs. 2A–C).

Por las características de las semillas, *Nanarepenta juxtlahuacensis* y en general las especies restantes del género, parecen estar cercanamente relacionadas con *Epipetrum* Philippi de Chile, como

fue sugerido por Matuda (1961), al describir *Nanarepenta.*

Por otra parte, el patrón celular de *N. juxtlahuacensis,* tiene mucha semejanza con el de *N. guerrerensis* y *D. mcvaughii* (= *N. mcvaughii* ined.), y a su vez difiere considerablemente de aquel con células largamente rectangulares de *D. minima* (= *N. minima* ined.) y *D. multinervis* (= *N. tolucana*).

En relación a la morfología de los granos de polen de *N. juxtlahuacensis,* a continuación se describen las características de acuerdo con Erdtman (1952), Punt et al. (1994) y Vezey y Skvarla (1994) (Fig. 3A–F):

Mónada; heteropolar; bilateral; prolato; 2-colpado, colpos 18–30 × 0.3 m, con terminaciones redondeadas; exina: Tectado-perforada, punteada, con lúmenes de 31.2–400.0 × 31.2–160.0 nm en diámetro (15,000 y 35,000×, MEB), lisa; eje ecuatorial mayor: 25 μm (22.25–36.25 μm); eje ecuatorial menor: 17 μm (10.25–23.75 μm); grosor promedio de muri 432 nm (35,000 ×, MEB); lúmina por unidad de área: 20 por 1 μm^2 (15,000×, MEB), 51 por 7 μm^2 (35,000×, MEB), 84 por 16 μm^2 (15,000×, MEB); distancia interluminar promedio: 520 nm (35,000×, MEB).

El polen de las especies de *Nanarepenta* mostró ser semejante al de diversas especies de los géneros *Dioscorea, Epipetrum, Rajania* y *Tamus.* Situación que no ha permitido interpretar en forma objetiva este caracter en un contexto global. Al parecer, al igual que otros caracteres morfológicos encontrados en la familia, los tipos polínicos semejantes representan estados paralelos en diferentes líneas en Dioscoreaceae. Sin embargo, es factible señalar que los caracteres de los granos de polen encontrados entre las especies de *Nanarepenta* permiten diferenciar a cada una de estas claramente. Por ejemplo, *N. juxtlahuacensis* como ya se indicó posee granos tectado-perforados, punteados; en contraste, *N. guerrerensis* la especie más cercana relacionada, tiene granos semitectados, microreticulados.

Agradecimientos. Agradecemos a Enrique Martínez Hernández y Luis Hernández Sandoval, por las correcciones al manuscrito y las atinadas sugerencias. A Ismael Calzada y Gabriel Flores por su apoyo para colectar esta especie. A Anabel Duarte por el dibujo de la especie. Al Programa de Apoyo a las Divisiones de Estudios de Posgrado (PADEP 003373-UNAM) por su apoyo financiero para desarrollar parte de esta investigación.

Literatura Citada

Erdtman, G. 1952. Pollen Morphology and Plant Taxonomy. Chronica Botanica, Waltham, Massachusetts.

Gunn, C. R. & M. J. Seldin. 1976. Seeds and fruits of North American Papaveraceae. Techn. Bull. U.S.D.A. 1517.

Maas, P. J. M. & T. Rübsamen. 1986. Triuridaceae. Flora Neotropica Monogr. 40: 1–55.

——— & P. Ruyters. 1986. *Voyria* and *Voyriella* (Saprophytic Gentianaceae). Flora Neotropica Monogr. 41: 1–93.

———, H. Maas-van de Kamer, J. van Benthem, H. C. M. Snelders & T. Rübsamen. 1986. Burmanniaceae. Flora Neotropica Monogr. 42: 1–189.

Matuda, E. 1961. Nuevas Plantas de México. Anales Inst. Biol. Univ. Nac. México 32: 143–147.

———. 1974. Nueva *Nanarepenta* de Guerrero. Cact. Suc. Mex. 19(3): 70–71.

Punt, W., S. Blackmore, S. Nilsson & A. Le Thomas. 1994. Glossary of Pollen and Spore Terminology. LPP Contributions Series No. 1. LPP Foundation, Utrecht.

Schubert, B. G. 1989. Dioscoreaceae. *En:* W. R. Anderson (editor), Flora Novo-Galiciana. A Descriptive Account of the Vascular Plants of Western Mexico. Univ. Michigan Herb. 15: 355–388.

Vezey, E. L. & J. K. Skvarla. 1994. Searching for foveolate pollen exine. Rev. Palaeobot. Palynol. 83: 73–81.

Volume 8, Number 2, pp. 105–214 of NOVON was published on 15 July 1998.

Volume 8
Number 3
1998

NOVON

Two New Species of *Heteropterys* (Malpighiaceae) from Southern South America

William R. Anderson

University of Michigan Herbarium, North University Building, Ann Arbor, Michigan 48109-1057, U.S.A.

ABSTRACT. *Heteropterys mulgurae*, from Misiones, Argentina, and Paraná, Brazil, and *H. schulziana*, from Salta, Argentina, are described as new, and the distinction of each from its closest sister species is discussed.

In the course of treating the Malpighiaceae for the forthcoming *Catálogo de las Plantas Vasculares de la Argentina*, I have encountered two new species that require description, and that is the purpose of this brief contribution.

Heteropterys mulgurae W. R. Anderson, sp. nov. TYPE: Argentina. Misiones: Dep. San Ignacio, Santa María, 24 Aug. 1946 (fr), *G. J. Schwarz 3218* (holotype, LIL).

Species affinis *Heteropterydis nitidae* (Lamarck) DC. sed differt glandulis abaxialibus laminae margine vel usque ad 1 mm intra marginem portatis, petiolo plerumque biglanduloso in dimidio distali, samara usque ad 34 mm longa ala dorsali in costam crassam abaxialem circum nucem extensa, pilis folii samaraeque 0.6–0.8 mm longis relative laxis, et bracteolis 1.5–2 mm longis, ellipticis, lateribus saepe revolutis.

Woody vine; stems initially sericeous, gradually glabrescent during the first year, developing whitish punctiform to somewhat elongated lenticels, the axillary buds sericeous with dark brown hairs. Lamina of larger leaves 9–15.5 cm long, 3.3–6 cm wide, narrowly elliptical or slightly ovate or obovate, cuneate to nearly rounded at base, broadly obtuse to rounded or emarginate and often apiculate at apex, bearing a row of 5–20 small glands from base to apex along abaxial margin or within 1 mm of margin, adaxially initially sericeous but soon quite glabrate, abaxially densely and persistently metallic-sericeous with a continuous underlayer of white hairs and a thinner overlayer of brown hairs, the longer hairs 0.6–0.8 mm long, straight, ± strongly appressed, the principal lateral veins 7–10 pairs, more prominent below than above, the fine reticulum visible above; petiole of larger leaves 9–12 mm long, persistently sericeous, mostly biglandular between middle and apex (eglandular in *Hatschbach 52790*); stipules 0.5–0.7 mm long, triangular, borne on very base of petiole. Inflorescence terminal and axillary, paniculate, sericeous or loosely sericeous to glabrescent in age; flowers borne ultimately in umbels of (3–)4–5(–6) flowers, occasionally with an additional pair of flowers borne more proximally; bracts 1.5–2 mm long, elliptical, erect to spreading, eglandular, abaxially sericeous, adaxially glabrous, persistent; peduncle 3.5–9 mm long, sericeous or glabrescent in age; bracteoles like the bracts but more rounded distally and often somewhat revolute at sides, borne at apex of peduncle; pedicel 4–6 mm long, sericeous or glabrescent in age. Sepals somewhat loose in bud, strongly appressed in anthesis, 1.2–2 mm long beyond glands, 1.7–2.5 mm wide, triangular and obtuse or rounded at apex, abaxially densely and persistently golden-sericeous or appressed-tomentose over the whole surface to glabrescent in fruit, adaxially glabrous, the lateral 4 bearing 8 glands 1.7–2.5 mm long, elliptical or slightly ovate, distally detached and eventually spreading. Petals yellow, strongly reflexed in anthesis, glabrous or with a few appressed hairs on abaxial rib, the claw 1–1.5 mm long, the limb 3–3.5

mm long, 2–2.2 mm wide, ovate or roughly rectangular, distally erose or denticulate, proximally bearing several marginal glands especially near base, abaxially carinate, the posterior petal similar in size and shape to the lateral 4 but with a thicker claw and larger marginal glands. Filaments 1.7–2.3 mm long, longer opposite sepals than opposite petals, slender, erect or reflexed at apex, abaxially loosely sericeous on proximal half at least where adjacent filaments are connate, adaxially glabrous, connate for ½–⅔ of their length; anthers 1–1.3 mm long, alike, glabrous. Ovary 1–1.2 mm high, densely tomentose, each carpel with an abaxial crest under the hairs but no lateral crests; styles 1.2–1.7 mm long, glabrous, relatively stout, erect to diverging from the base and distally somewhat recurved, with the stigma distinctly internal and dorsally truncate or slightly acute at apex. Samara 27–34 mm long; nut subspheroidal, 5–7 mm long and 4.5–6 mm across, completely without lateral appendages, appressed-tomentose; dorsal wing 9–11 mm wide distally, extending around the nut abaxially as a thick rib, loosely sericeous with the hairs 0.6–0.8 mm long.

Distribution. Misiones, Argentina, and the adjacent state of Paraná, Brazil. The two Argentinian collections of *H. mulgurae* came from near the Río Alto Paraná, so the species must occur on the Paraguayan side of that river, but as far as I know it has not been collected there.

Etymology. I am happy to name this species in honor of María Ema Múlgura de Romero (b. 1943), enthusiastic student of Argentinian Malpighiaceae.

Múlgura de Romero (1981) reported this species as new for Argentina and illustrated it with a drawing that is generally accurate except that it exaggerates the degree to which the leaf glands are set in from the margin. She called it *Heteropteris nitida* (Lamarck) Kunth, which is correctly cited *Heteropterys nitida* (Lamarck) DC., because the spelling *Heteropterys* is now conserved and Kunth did not validly publish the combination. *Heteropterys nitida* is a rather common species along the coast of Brazil from Bahia south to Paraná, just reaching Santa Catarina and extending inland as far as eastern Minas Gerais. After reviewing the complex to which these plants belong, series *Metallophyllis* (Niedenzu, 1928), I have concluded that Múlgura was correct that *H. nitida* is the closest relative of the plant described above as *H. mulgurae*, and it would have been convenient to leave it there, but that has the disadvantage of depriving a well-marked species of some of its most useful distinctions. The couplet below summarizes the differences between the two species that are apparent from the material now available.

1a. Abaxial lamina glands borne at margin or within 1 mm of margin; petiole biglandular on distal half or eglandular; samara up to 34 mm long, with the dorsal wing extended around nut abaxially as a thick rib; hairs of leaf and samara 0.6–0.8 mm long, relatively loose; bracteoles 1.5–2 mm long, elliptical, often revolute at sides . . . . . *H. mulgurae* W. R. Anderson

1b. Abaxial lamina glands set well in from margin, those of larger leaves mostly 5 mm or more from margin; petiole eglandular; samara (35–)37–52 mm long, with the dorsal wing merging smoothly into the nut at apex or slightly below; hairs of leaf and samara 0.2–0.4 mm long, very tight; bracteoles 0.7–1.3(–1.5) mm long, ovate, flat or involute at sides . . . . . *H. nitida* (Lamarck) DC.

Paratypes. ARGENTINA. **Misiones:** Dep. Iguazú, P. N. Iguazú, Isla Grande, frente a Pto. Canoas, interior de selva, 31 Mar. 1995 (fl), *Vanni et al. 3374* (CTES, MICH). BRAZIL. **Paraná:** Rod. PR-11, 4–5 km S de Senges, orla da mata, 27 Jan. 1989 (fl), *Hatschbach 52790* (MICH).

Heteropterys schulziana W. R. Anderson, sp. nov. TYPE: Argentina. Salta: Quebr. Yariguarenda [eastern slopes of Sierra de Tartagal], Las Piletas, ladera cerro, cuelga en barrancas, 1 Jul. 1944 (fl), *A. G. Schulz 509* (holotype, CTES; isotype, LIL).

Species affinis *Heteropterydis cochleospermae* Adrien de Jussieu sed differt lamina minore pilis rectis sessilibus appressis instructa, petiolo eglanduloso, petalis abaxialiter carinatis, et stigmate ut videtur terminali.

Pendent shrub with flexible (perhaps facultatively twining) woody stems; youngest stems sericeous, soon glabrate, developing punctiform lenticels in the first year; older stems 5 mm diam., with elongated splits and raised fissures; axillary buds densely ferrugineous-sericeous. Lamina of larger leaves 3–4 cm long, 1.6–2.2 cm wide, ovate or elongate-ovate, broadly obtuse to rounded at base, flat at margin, acute to broadly obtuse or rounded and often apiculate at apex, eglandular or bearing 1–2 small but mostly prominulous glands on very margin well above base but below middle, initially sericeous on both sides but soon glabrescent and often nearly or quite glabrate at maturity, the hairs 0.3–0.6 mm long, fine, white, sessile, straight, appressed, the principal lateral veins 5–7 pairs, the veins and reticulum visible on both sides in dried leaves, slightly raised below; petiole of larger leaves 4–5.5 mm long, initially sericeous but soon glabrate, eglandular; stipules 0.2–0.4 mm long, triangular, borne on very base of petiole. Inflorescences terminating currently leafy stems or axillary to current leaves, simple or ternate, loosely sericeous to gla-

brescent, containing much-reduced leaves like the larger leaves but more likely to have marginal glands; flowers borne ultimately in umbels or corymbs of 4–7 flowers, often with an additional pair of flowers borne more proximally; bracts 0.6–1.4 mm long, very narrowly triangular, spreading to appressed, eglandular, loosely hairy to nearly glabrous except for spreading hairs on margin, persistent; peduncle 3–5 mm long, thinly sericeous to glabrate; bracteoles like the bracts but smaller, 0.6–0.9 mm long, swollen at base and strongly appressed, one or both borne below apex of peduncle with one usually lower than the other; pedicel 6–10 mm long, thinly sericeous to glabrate. Sepals loose to somewhat spreading in bud, spreading to distally reflexed in anthesis, 1.5–1.7 mm long beyond glands, 0.9–1.1 mm wide, narrowly triangular and obtuse or rounded at apex, abaxially loosely sericeous especially proximally, adaxially glabrous, the lateral 4 bearing 7–8 glands 1.3–1.8 mm long, elliptical or somewhat obovate. Petals "pink" [yellow?], glabrous, the claw ca. 1 mm long, the limb 3.2–3.5 mm long, 1.6–2 mm wide, narrowly elliptical, eglandular, denticulate or slightly erose, abaxially slightly carinate on the proximal half, the posterior petal apparently hardly different in size and shape from the lateral 4. Filaments 2.3–2.9 mm long, longer opposite sepals than opposite petals, slender and reflexed at apex, glabrous, basally connate; anthers 0.9–1 mm long, alike, glabrous. Ovary 1.5 mm high, densely sericeous, each carpel with an abaxial crest under the hairs; styles 1.8–2.2 mm long, glabrous, slender, erect or diverging from the base, straight or slightly recurved, truncate at apex with the stigma terminal or perhaps very slightly internal but without any apical-dorsal angle or hook. Fruit unknown.

Distribution. I recently surveyed the Malpighiaceae in all the major herbaria of Argentina and found no collections of this species other than the holotype and isotype. I can also find no collections of it in the extensive holdings of Malpighiaceae at the University of Michigan, so for now it will have to be considered endemic to Argentina, but I expect that it will eventually be found in southern Bolivia.

Etymology. This interesting plant is named in honor of its collector, the Argentinian botanist Augusto Gustavo Schulz (1899–1992).

The species closest to *Heteropterys schulziana* is probably *H. cochleosperma* Adrien de Jussieu (= *H. hassleriana* Niedenzu), which occurs in Bolivia, Mato Grosso, and Paraguay, as well as farther east. In *H. cochleosperma* the leaf is usually larger than in *H. schulziana,* with looser hairs, and there is always a pair of large glands on the distal half of the petiole or at the very base of the lamina. Its petals are abaxially smooth, not carinate, and the stigma is distinctly internal, with the style apex dorsally rounded to acutely angled. *Heteropterys cochleosperma* and its relatives have yellow petals, so if the petals of *H. schulziana* are really pink as noted by the collector ("fl. rosada"), that will be an additional distinction, but I shall be surprised if they do not turn out to be yellow. In placing *Heteropterys schulziana* near *H. cochleosperma* I am especially influenced by the marginal lamina glands, the umbellate inflorescence, and the strongly appressed bracteoles borne below the apex of the peduncle. Another species in that complex is *H. krapovickasii* W. R. Anderson from Bolivia and Mato Grosso, which differs from *H. schulziana* in the same characters as *H. cochleosperma,* and is also distinguished by the vesture of its laminas, which are abaxially densely and persistently sericeous.

Acknowledgments. I acknowledge with gratitude the curators of the herbaria of the Instituto de Botánica del Nordeste in Corrientes and the Fundación Miguel Lillo in Tucumán for allowing me to study the Malpighiaceae in their collections. Gert Hatschbach, of the Museu Botânico Municipal in Curitiba, provided one of the paratypes of *Heteropterys mulgurae.* I would also like to send personal thanks to the following individuals who made my recent work in Argentinian herbaria a pleasure as well as a success: Carmen Cristóbal, Antonio Krapovickas, María Ema Múlgura de Romero, Aurelio Schinini, Ricardo Vanni, and Fernando Zuloaga.

Literature Cited

Múlgura de Romero, M. E. 1981. Dos especies de *Heteropteris* (Malpighiaceae) nuevas para la flora Argentina. Darwiniana 23: 311–315.

Niedenzu, F. 1928. Malpighiaceae *in* A. Engler (editor), Das Pflanzenreich IV, 141: 1–870.

The Status of *Teesdaliopsis* and *Teesdalia* (Brassicaceae)

Oliver Appel
Institut für Allgemeine Botanik, Ohnhorststraße 18, 22609 Hamburg, Germany

ABSTRACT. The genus *Teesdaliopsis* is reduced to synonymy of *Teesdalia*. The new combination *Teesdalia conferta* is proposed. A key to the three species of *Teesdalia* is provided.

The genus *Teesdalia* (2 spp.) is one of about ten genera of the Brassicaceae that have zygomorphic flowers (Rollins, 1963). It is apparently closely related to *Iberis* (von Hayek, 1911; Schulz, 1936). Based on *Iberis conferta* Lagasca, Willkomm (1880) described the monotypic section *Teesdaliopsis*, which was elevated to generic rank by Rothmaler (1940). According to Rothmaler, *Teesdaliopsis* was said to be closely related to *Teesdalia* but clearly differed by having 1-seeded instead of 2-seeded locules. However, Ball et al. (1993) showed that the seed number is unreliable and that only the annual vs. perennial habit can be used to separate *Teesdalia* and *Teesdaliopsis*, respectively. A critical comparison of the three species of these genera is shown in Table 1.

Teesdalia and *Teesdaliopsis* are distinguished, respectively, by the annual vs. perennial habit and two vs. one ovule per locule. On the other hand, both *Teesdalia nudicaulis* and *Teesdaliopsis conferta* share zygomorphic flowers, and all three species share appendaged filaments and winged fruits that are extremely similar. The combination of zygomorphic flowers, appendaged filaments, and winged fruits is rare in the Brassicaceae. The differences between these two genera are so minor that *Teesdaliopsis* is best placed within *Teesdalia*. The three species of *Teesdalia* are separated as follows:

1a. Plants perennial, ovules 1 per locule . . . . . *T. conferta* (Lagasca) O. Appel
1b. Plants annual, ovules 2 per locule.
  2a. Basal leaf lobes obtuse, flowers zygomorphic, petals longer than sepals, stamens 6 . . . . . *T. nudicaulis* (L.) R. Brown
  2b. Basal leaf lobes acute or leaves entire, flowers actinomorphic, petals not exceeding sepals, stamens usually 4 . . . . *T. coronopifolia* (J. P. Bergeret) Thellung

1. Teesdalia conferta (Lagasca) O. Appel, comb. nov. Basionym: *Iberis conferta* Lagasca, Varied. Cienc. 2(22): 213. 1805. TYPE: no collection data (holotype, MA?).

Acknowledgments. The author is indebted to Ihsan Al-Shehbaz for his support and for reviewing the manuscript.

Literature Cited

Ball, P. W., V. H. Heywood & J. R. Akeroyd. 1993. Cruciferae. *In*: T. G. Tutin et al. (editors), Flora Europaea ed. 2, 1: 313–417.

Hayek, A. von. 1911. Entwurf eines Cruciferen-Systems auf phylogenetischer Grundlage. Beih. Bot. Centralbl. 27: 127–335.

Table 1. A comparison of *Teesdalia nudicaulis*, *T. coronopifolia*, and *Teesdaliopsis conferta*.

	Teesdalia nudicaulis	*Teesdalia coronopifolia*	*Teesdaliopsis conferta*
Habit	annual	annual	perennial
Basal leaves	pinnatifid	pinnatifid to entire	entire
Apex of basal leaves	obtuse	acute	acute
Stem leaves	present or lacking	present or lacking	lacking
Trichomes	present or lacking	present or lacking	lacking
Petal length	longer than sepals	as long as sepals	longer than sepals
Petal size	unequal	± equal	unequal
Stamen number	6	usually 4	6
Filaments	appendaged	appendaged	appendaged
Ovules per locule	2	2	1
Stigma	entire	entire	entire
Style	obsolete	lacking	obsolete
Seeds per locule	1 or 2	1 or 2	1

Rollins, R. C. 1963. The evolution and systematics of *Leavenworthia* (Cruciferae). Contr. Gray Herb. 192: 3–98.

Rothmaler, W. 1940. De flora Occidentali. 1. Feddes Repert. 49: 169–184.

Schulz, O. E. 1936. Cruciferae. *In*: A. Engler & K. Prantl (editors), Nat. Pflanzenfam. ed. 2, 17B: 227–658.

Willkomm, M. 1880. Cruciferae. *In*: M. Willkomm & J. Lange (editors), Prodromus Florae Hispanicae 3: 747–870.

Carex mckittrickensis (Cyperaceae), a New Species from Western Texas

Peter W. Ball

Department of Botany, Erindale College, University of Toronto, Mississauga, Ontario, L5L 1C6, Canada

ABSTRACT. *Carex* (sect. *Albae*) *mckittrickensis* is described as a new species from Guadalupe Mountains National Park, Texas. It is similar to *C. eburnea* but has larger staminate and pistillate scales and larger perigynia with a longer beak. It is over 1000 km disjunct from the nearest known stations of *C. eburnea* in Arkansas and Nebraska.

Carex sect. *Albae* Ascherson & Graebner consists of three allopatric species that occur in the cool temperate regions of the Northern Hemisphere. They are small, caespitose plants with a few long rhizomes, very narrow filiform or inrolled leaves, separate staminate and pistillate spikes, long-sheathing but usually bladeless bracts, glabrous perigynia with a short entire beak, the style enlarged proximally but deciduous in fruit, three stigmas, and the achene almost filling the perigynium.

Carex alba Scopoli occurs in Europe and cool temperate Asia. The European plants can be recognized by the pedunculate staminate spike usually 10–15 mm long and the perigynia 3.5–4 mm long. The descriptions of this species based on Asian specimens (Charkevicz, 1988; Voroschilov, 1965) are similar, but the perigynia (2.8–3.5(–4.0) mm long) and the staminate spikes ((5–)7–10(–15) mm long) are on average smaller. Voroschilov (1965) described one collection as a new species, *Carex ajanensis*, but he did not differentiate it from *C. alba*, and the protologue does not contain any information distinguishing it from that species. Charkevicz (1988) treated *Carex ajanensis* as a synonym of *C. alba*. *Carex ussuriensis* Komarov, from extreme northeast Asia, sometimes treated as a subspecies of *C. alba*, has the perigynia mostly 3–3.3 mm long and a long and lax inflorescence. *Carex eburnea* Boott is widespread in North America, ranging from Alaska, British Columbia, Montana, and Nebraska eastward to Newfoundland and New Jersey, and southward to South Carolina and Arkansas at higher elevations. It is readily distinguished from the Eurasian species by the sessile or subsessile staminate spike 3–10 mm long and the perigynia 1.5–2.2(–2.4) mm long.

Plants determined as *Carex eburnea* were first collected in western Texas in 1931 and again in 1958, but Correll and Johnston (1970) noted that they differed from typical *C. eburnea* in having larger pistillate scales and larger perigynia. These collections were made in late July, when the fruits were fully mature; consequently, once dried, the perigynia and pistillate scales had mostly fallen off the plants. Fortunately, in some of the mounted specimens this material had been preserved in packets. Enquiries sent to herbaria in Texas revealed that this plant had been collected on two subsequent occasions, probably from the same station, the south branch of McKittrick Canyon in Guadalupe Mountains National Park, by T. L. Burgess (flowering material in March 1975 and fruiting material in July 1976 (TEX)). These additional collections made it possible to more thoroughly compare the Texas population with *C. eburnea* from elsewhere in North America.

Throughout North America *Carex eburnea* shows relatively little geographic variation. Plants from the extremes of its range are essentially indistinguishable from each other. However, the Texas population differs from *Carex eburnea* in a number of quantitative characters. The most important of these are the staminate scales 3.5–6.5 mm long (vs. 2.8–4 mm), the anthers 2–2.2 mm long (vs. 1.3–1.8 mm), the pistillate scales 2.1–3.5 mm long (vs. 1.0–2.0 mm), the perigynia 2.2–2.9 mm long (vs. 1.5–2.2(–2.4) mm), and the perigynium beak 0.5–0.7 mm long (vs. 0.2–0.4(–0.5) mm). The Texas plants are generally more robust than *Carex eburnea*, but in vegetative features they are not consistently distinguishable. There are two qualitative characters that may aid in distinguishing the Texas plants, although they do not give an absolute separation. The pistillate scales about equal or are only slightly shorter than the perigynia in the Texas plants, while in *Carex eburnea* the scales are usually much shorter than the perigynia. The perigynia are also distinctly nerved in the Texas plants, while in *Carex eburnea* mature perigynia range from almost nerveless to moderately strongly nerved. It

Table 1. List of characters and acronyms used in Principal Components Analysis.

Achene length (mm)	ACHL
Achene width (mm)	ACHW
Perigynium beak length (mm)	BKL
Perigynium length (mm)	PERL
Perigynium width (mm)	PERW
Perigynium widest point (mm from base)	PERWP
Pistillate scale length (mm)	PSCL
Pistillate scale width (mm)	PSCW
Staminate scale length (mm)	STSCL
Staminate scale width (mm)	STSCW
Stem height (cm)	STHT

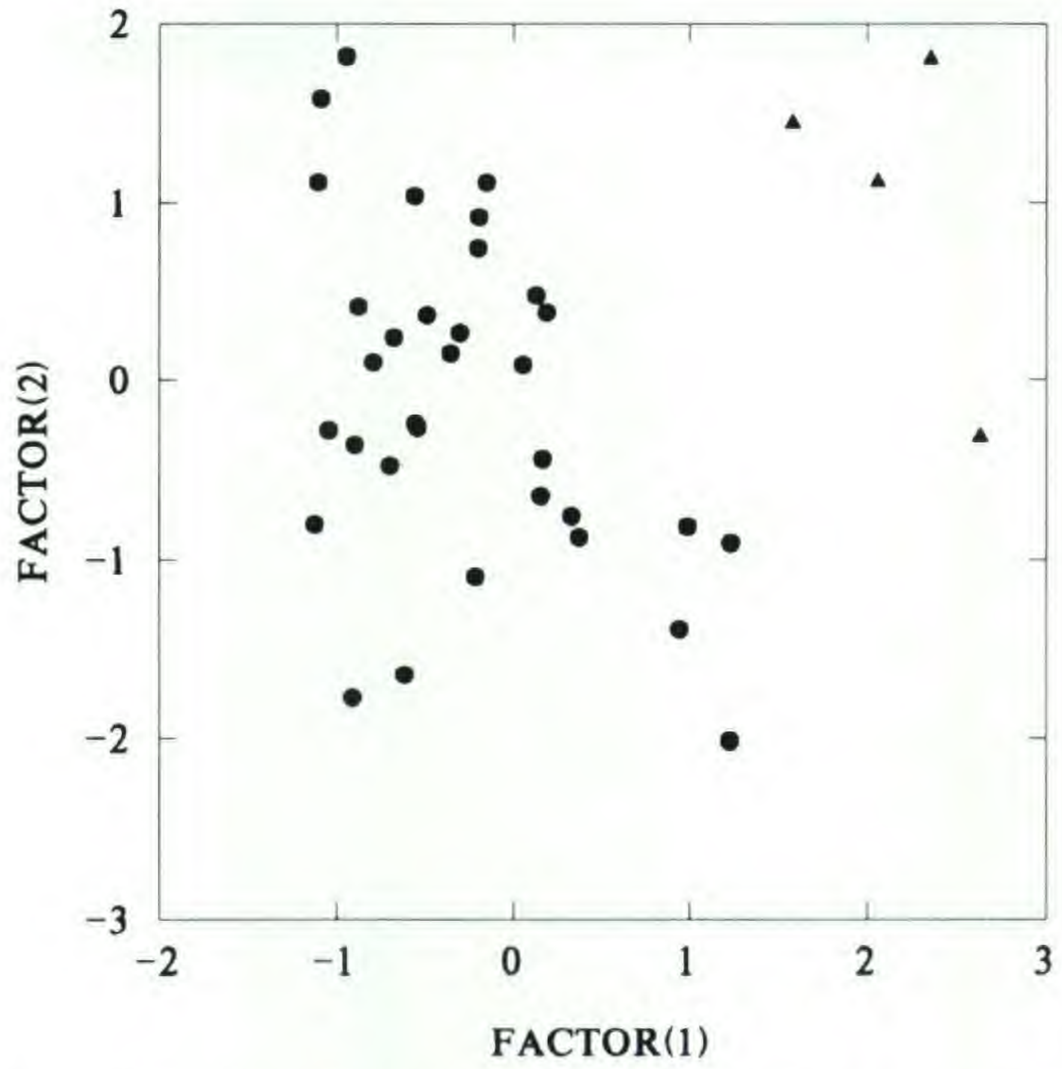


Figure 1. Bivariate plot of scores of OTUs of *Carex eburnea* (circles) and *C. mckittrickensis* (triangles) on principal components 1 and 2.

should be noted that the anther length measurements reported here are based on limited samples. The size for the Texas plants is based entirely on one collection, *Burgess 3002* (TEX), a collection of flowering plants taken in March. The difference between the Texas plants and *Carex eburnea* in staminate scale size suggests that there is probably a significant difference between the two in anther size, but it is not yet certain that this is an absolute difference which can reliably distinguish them.

In order to obtain an overall evaluation of the Texas population, a principal components analysis, utilizing the characters listed in Table 1, was undertaken using SYSTAT 5.0 (Wilkinson, 1990). The data used in this analysis were standardized to zero mean and unit variance. The analysis included 4 specimens of *Carex eburnea* from Texas and 33 specimens from Alberta, Montana, and western Northwest Territories east and south to Newfoundland, North Carolina, Alabama, and Arkansas. A bivariate plot of the scores of individual specimens on the first two components is shown in Figure 1. The first component accounted for over 44% of the variance in the data set with PERL, PSCL, STHT, PERWP, ACHL, and STSCL having high loadings. The second component accounted for a further 14% of the variance with PSCW, ACHW, and PERW with high loadings. These latter characters for the most part do not distinguish the Texas plants from *Carex eburnea.*

It seems reasonable to conclude that the Texas plants should be treated as a distinct species. They consistently differ from *Carex eburnea* in several morphological characters, and in some respects seem to be intermediate between this species and the Eurasian species of section *Albae.* The only known locality is over 1000 km disjunct from the nearest station for *C. eburnea* to the east in northern Arkansas, and further still from the nearest stations to the north in southern British Columbia, Montana, and northern Nebraska.

Carex (sect. *Albae*) **mckittrickensis** P. W. Ball, sp. nov. TYPE: U.S.A. Texas: Culberson Co., Guadalupe Mountains, S fork of McKittrick Canyon, 2 July 1958, *D. S. Correll & I. M. Johnston 19187* (holotype, TEX (LL); isotypes, BRIT, MICH, NC). Figure 2.

Plantae cespitosae, rhizomatibus; culmi 22–35 cm alti. Folia 3–4; laminae ad 17 cm longae, 0.5–1 mm latae, filiformes. Spicae 3–5; spica terminalis 4.5–7 mm longa, 0.7–0.9 mm lata, omnino mascula, subsessilis, spicas superas laterales non superans; spicae laterales 6–7 mm longae, 1.5–3 mm latae, omnino femineae, in pedunculis erectis ad 16 mm longis portatae. Squamae masculae 3.5–6.5 mm longae, 1.2–1.8 mm latae; antherae 2.0–2.2 mm longae. Squamae femineae 2.1–3.5 mm longae, 0.9–1.4 mm latae, oblongo-ovatae ad late ovatae. Perigynia 2.2–2.9 mm longa, 0.9–1.1(–1.2) mm lata, in rostrum 0.5–0.7 mm longum abrupte contracta. Achenium 1.6–1.9 mm longum, 0.8–1.1 mm latum, late obovoideo-ellipsoideum.

Plant caespitose with a few long rhizomes; glabrous. Fruiting stems 22–35 cm high, erect, exceeding the leaves, covered with light brown to reddish brown bladeless sheaths at the base; essentially round in cross section, 0.5–1 mm diam., with slender ridges, smooth, with 3–4 blade-bearing leaves in the lower ⅕. Leaf blades up to 17 cm long, 0.5–1 mm wide, filiform or inrolled, smooth except for teeth near the apex; sheaths up to 20 mm long, the inner band white or pale brown, membranous; ligule truncate to shortly triangular. Inflorescence with 3–5 spikes, the terminal staminate,

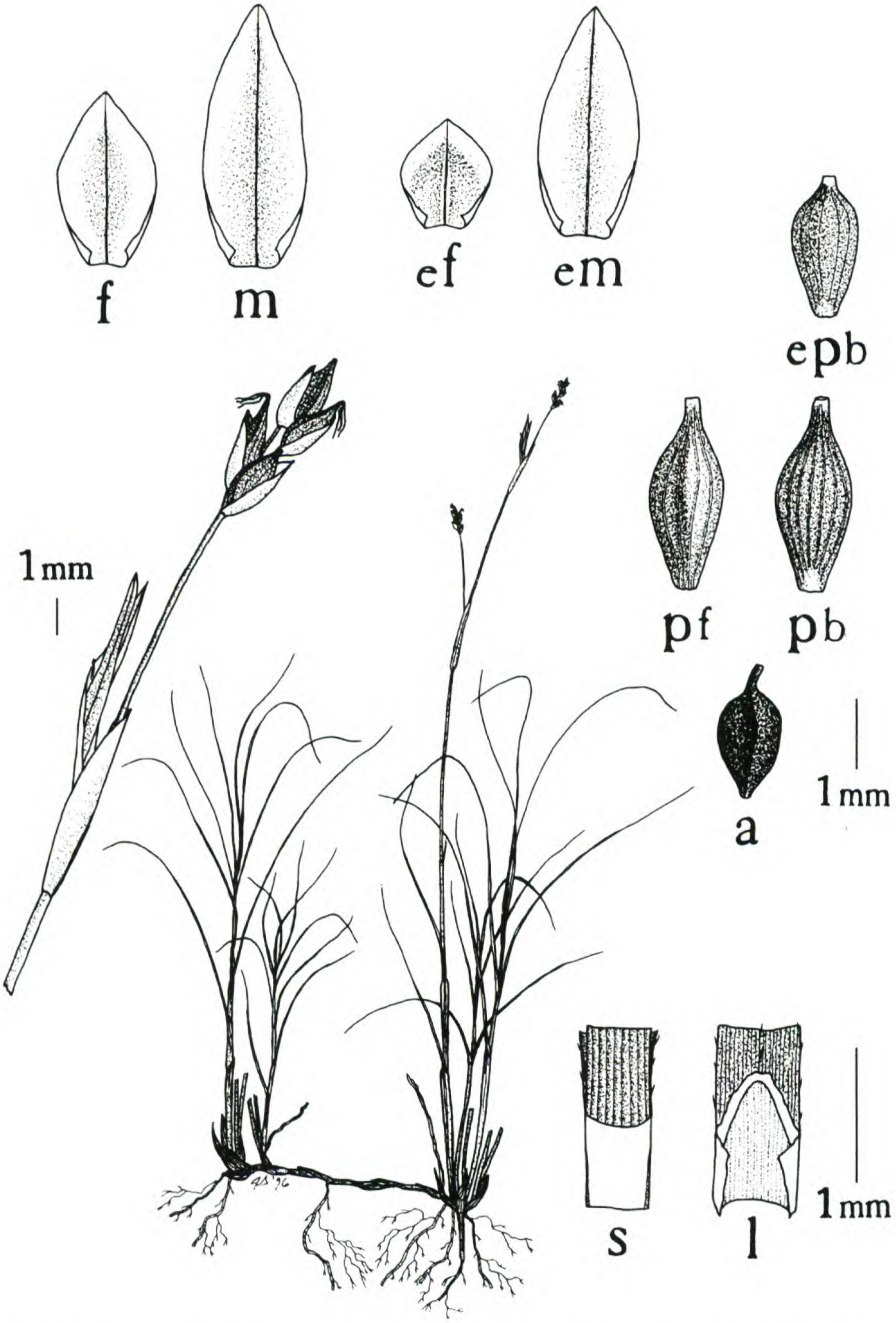


Figure 2. *Carex mckittrickensis* P. W. Ball. Habit, inflorescence, female (pistillate) scale (f), male (staminate) scale (m), perigynium front (adaxial face) (pf), perigynium back (abaxial face) (pb), achene (a), sheath front (s), ligule (l). *Carex eburnea.* Female (pistillate) scale (ef), male (staminate) scale (em), perigynium back (abaxial face) (epb).

Table 2. Comparison of characters of species of *Carex* sect. *Albae*.

Characters	*C. eburnea*	*C. mckittrickensis*	*C. ussuriensis*	*C. alba*	*C. alba* (Siberia)
Bract length (mm)	usually 0	usually 0	0–30	0–10	0
Staminate spike peduncle length (mm)	0–1	0–1	10–50	7–20	2–9
Staminate spike length (mm)	3–10	4.5–7	9–14	(5–)10–15	7–10
Staminate scale length (mm)	2.6–4	3.5–6.5	3.7–6.0	5.0–6.0	ca. 5.5
Anther length (mm)	1.3–1.8	2.0–2.2	3.1–4	3.0–5.0	n/a
Pistillate scale length (mm)	1.0–2.0	2.1–3.5	2.2–3.0	2.6–3.6	1.5–1.7
Perigynium length (mm)	1.5–2.2(–2.4)	2.2–2.9	(2.5–)3–3.3(–3.7)	2.8–4.0	2.1–2.5
Perigynium beak length (mm)	0.2–0.4(–0.5)	0.5–0.7	0.4–0.6	0.4–0.7	0.1–0.2
Achene length (mm)	1.4–1.8	1.6–1.9	1.7–2.2	2.1–2.5	ca. 1.7

appearing sessile, with the peduncle included in or exserted not more than 1 mm from the sheath of the distal bract; lateral spikes pistillate with peduncles up to 10–16 mm long; bracts bladeless, sheaths 4–10 mm long. Staminate spikes 4.5–7 mm long, 0.7–0.9 mm wide, with 3–4 flowers, usually overtopped by the distal pistillate spikes; staminate scales 3.5–6.5 mm long, 1.2–1.8 mm wide, oblong-ovate, acute or subobtuse, membranous, white-hyaline, with a thin brown midvein; anthers 2.0–2.2 mm long. Pistillate spikes with 3–5 flowers, the proximal spike 6–7 mm long, 1.5–3 mm wide, erect; pistillate scales 2.1–3.5 mm long, 0.9–1.4 mm wide, elliptic-obovate to broadly ovate, acute or subobtuse, white hyaline to light brown with a hyaline margin, with a green to brown midvein, slightly shorter than to about equaling the perigynia. Perigynia 2.2–2.9 mm long, 0.9–1.1(–1.2) mm wide, elliptic-obovate, widest above the middle of the body, tapering to the base, abruptly contracted to the beak, light to medium brown or black when mature, ± trigonous with rounded angles, distinctly 12–15-nerved; beak 0.5–0.7 mm long, straight or bent, entire or emarginate, smooth. Achenes 1.6–1.9 mm long, 0.8–1.1 mm wide, broadly obovoid-ellipsoid, trigonous, dark brown to black, minutely papillose, ± filling the perigynium body; style enlarged in the proximal half, deciduous. Stigmas 3.

A comparison of the Texas plants with *Carex eburnea, C. alba,* and *C. ussuriensis* is shown in Table 2. The data for *Carex alba* and *C. ussuriensis* were derived from Anon. (1976), Chater (1980), Charkevicz (1988), Voroschilov (1965), and Kreczetowicz (1935), and a limited number of specimens available in TRT and MICH. The single Asian specimen of *Carex alba* that was seen is shown separately, as it differed in a number of important characters from the descriptions of Asiatic Russian plants (particularly Charkevicz (1988) and Voroschilov (1965)) and from European specimens. In some features, particularly staminate and pistillate scale lengths and perigynium beak length, *Carex mckittrickensis* is more similar to the Eurasian species than to *C. eburnea.* In other characters, such as anther length and perigynium length, it is intermediate between *Carex eburnea* and the Eurasian species. Finally, in characters such as staminate peduncle length, staminate spike size, and achene size, *Carex mckittrickensis* and *C. eburnea* are identical and differ from the Eurasian species.

The single Asian specimen of *Carex alba* that was seen is intermediate between European *C. alba* and *C. eburnea* in a number of characters (Table 2), although it can still be distinguished from both *C. eburnea* and *C. mckittrickensis.* It seems desirable to further investigate *Carex alba* in Asia to determine whether these populations should be afforded taxonomic recognition.

Ecologically, *Carex mckittrickensis* appears to be very similar to *C. eburnea.* It occurs on the sides of steep ravines and in the herb layer of riparian forest dominated by *Acer* and *Quercus* species. *Carex eburnea* often occurs in similar situations, although more usually in mixed forest or conifer forest, especially that dominated by *Thuja.* However, it can also occur in more open habitats such as on stabilized sand dunes and on alvars. Generally, *Carex eburnea* is associated with calcareous substrata. While no information is directly available on the soil in which *Carex mckittrickensis* occurs, the fact that one of the dominant trees in the forest is reported to be *Quercus muehlenburgii* suggests that the soil is neutral or base-rich. Another, possibly significant, feature of the forest in which *Carex mckittrickensis* occurs is that the two apparently dominant trees are elsewhere allopatric, their distibutions overlapping only in western Texas and in a few places in Nevada and the adjacent areas of

northern Mexico. *Carex mckittrickensis* should be searched for in these areas and perhaps also further south in Mexico where other eastern North American trees occur.

Paratypes. U.S.A. **Texas:** Culberson Co.: Guadalupe Mountains National Park, South McKittrick Canyon, ca. 0.4 km SW of Turtle Rock, ca. 2.4 km S, 0.9 km W of Pratt Lodge, elev. 5500 ft., 20 Mar. 1975, *T. L. Burgess 3002* (TEX); 2.3 km S, 0.8 km W of Pratt Lodge. elev. 5500 ft., 23 July 1976, *T. L. Burgess 4158* (TEX); along creek, alt. 1980 m, 22 July 1931, *Moore & Steyermark 3575* (MICH).

Acknowledgments. I thank the curators of BRIT, MICH, NC, TEX, and TRT for the loan of specimens; the curators of other herbaria who searched unsuccessfully for Texas specimens of *C. eburnea* on my behalf; C. Jarvis (BM) for locating and providing me with a copy of Voroschilov (1965); and Julie Saunders for preparing Figure 2. This work was supported by National Research Council of Canada Operating Grant A6494.

Literature Cited

Anon. 1976. *Carex*. Pp. 267–339 *in* Iconographia Cormophytorum Sinicorum V. Academia Sinica, Beijing.

Charkevicz, S. S. 1988. Plantae Vasculares Orientes Extremi Sovietici. 3. Akademii Nauk SSSR, Leningrad.

Chater, A. O. 1980. *Carex*. Pp. 290–323 *in* T. G. Tutin et al. (editors), Flora Europaea. V. Cambridge Univ. Press, Cambridge.

Correll, D. S. & M. C. Johnston. 1970. Manual of the Vascular Flora of Texas. Renner, Texas.

Kreczetowicz, V. I. 1935. *Carex*. Pp. 111–464 *in* V. L. Komarov (editor), Flora URSS 3. Akademii Nauk SSSR, Leningrad.

Voroschilov, V. N. 1965. Novye Vidy Dalnevostochnykh Rastenij. Bulleten Glavnogo Botanicheskogo Sada 60: 35.

Wilkinson L. 1990. SYSTAT: The System for Statistics. Evanston, Illinois.

Bulbophyllum involutum Borba, Semir & F. Barros (Orchidaceae), a New Species from the Brazilian "Campos Rupestres"

Eduardo L. Borba and João Semir*
Departamento de Botânica, UNICAMP, Caixa Postal 6109, 13081-970, Campinas-SP, Brazil
*Author to whom correspondence should be addressed

Fábio de Barros
Instituto de Botânica, Caixa Postal 4005, 01061-970, São Paulo-SP, Brazil

ABSTRACT. *Bulbophyllum involutum*, a new orchid species from the "campos rupestres" of Brazil, is described and illustrated, with notes about the biology of the species. It is also compared with *B. warmingianum*, *B. ipanemense*, and *B. longispicatum*.

Bulbophyllum Thouars is one of the largest orchid genera, with over 1100 species, and has a pantropical distribution, concentrated especially in the Old World Tropics (Dressler, 1993).

The last revision of this genus for Brazil was that of Cogniaux (1902); many species have been described more recently in various publications. At present, 54 *Bulbophyllum* species are recorded for this country (Pabst & Dungs, 1975, 1977). The lack of a recent revision has led to difficulty in identification of the Brazilian species and has frequently given rise to wrong determinations.

One of the major taxonomic problems in this genus involves a group of species mainly found in the Brazilian "campos rupestres," where about eight of these species are vegetatively uniform, and separation is only possible by use of very subtle floral characters that are difficult to recognize in herbarium material, in spite of relatively easy diagnosis in the field. These problems, in addition to the lack of a revision of the genus, have led to misinterpretations of some species, many of them being wrongly identified as *Bulbophyllum warmingianum* Cogniaux.

In the course of reproductive biology studies of some species of this complex (Borba & Semir, in press), several populations originally interpreted as *B. warmingianum* and *B. ipanemensis* Hoehne were seen to possess some traits that separate them as a distinct species, described as follows:

Bulbophyllum involutum Borba, Semir & F. Barros, sp. nov. TYPE: Brazil. Minas Gerais: São Gonçalo do Rio Abaixo, Estação de Pesquisa e Desenvolvimento Ambiental de Peti, 24 Apr. 1993 (fl, fr), *E. L. Borba 008* (holotype, BHCB). Figures 1, 2.

Bulbophyllo warmingiano Cogniaux, *B. longispicato* Cogniaux et *B. ipanemensi* Hoehne affinis, sed anthesi flore singulari, scapi bracteis floralibus purpureis, floribus purpureis majoribus, petalis ovatis, apice obtuso vel rotundato, basi labelli lobo terminale truncato vel subcordato cum margine involuto differt.

Lithophytic or occasionally epiphytic herbs. Roots thread-like, fasciculate, long. Rhizome 20–51 mm long between pseudobulbs, 3–6 mm diam., repent, covered with paleaceous sheaths. Pseudobulbs 19–41 × 12–22 mm, erect, ovoid, tetragonous, yellowish, monophyllous. Leaves 31–115 × 16–31 mm, sessile, erect-patent, rigid, coriaceous to slightly fleshy, elliptic-oblong to oblong, green, apex acute-apiculate, base attenuate and canaliculate. Inflorescence basal; scape 29–48 cm long, 2–3 mm diam., erect, rigid, purple, with 6–11 sheath-like bracts, 14–18 mm long, purple, later becoming paleaceous, apex obtuse; raceme 11–38 cm long, 11–30-flowered, loose, rachis purple, curved to horizontal. Floral bracts 7.5–10.5 × 3–4.5 mm, ovate, persistent, purple when young and paleaceous at anthesis, apex obtuse. Flowers resupinate by torsion of the pedicel. Ovary with pedicel 4–8 mm long, obconical, purple, sulcate. Sepals coriaceous, ovate-triangular, concave, boat-shaped, acuminate, dorsal face purple, ventral face green with purple spots and points; dorsal sepal 9.6–12.4 × 3.6–4.4 mm, erect; lateral sepals 10.4–11.3 × 3.8–4.9 mm, patent to reflexed, oblique. Petals 3.3–5.1 × 2–3.1 mm, membranaceous, oblique ovate, patent, purple with green spots, apex obtuse to rounded, margin ciliate. Labellum 5.3–8.1 × 2.7–3.9 mm, fleshy, in 45° angle with the column, articulated with the column foot; lateral lobes erect, ear-shaped, ciliate, dark purple with white spots; mid-lobe purple with white apex, concave, base truncate to cordate, apex rounded, lateral margins involute, ciliate; callus dark purple, oblong, proximal half longitudinally sulcate. Column 2.4–3.8 mm long, white with purple spots, with two long,

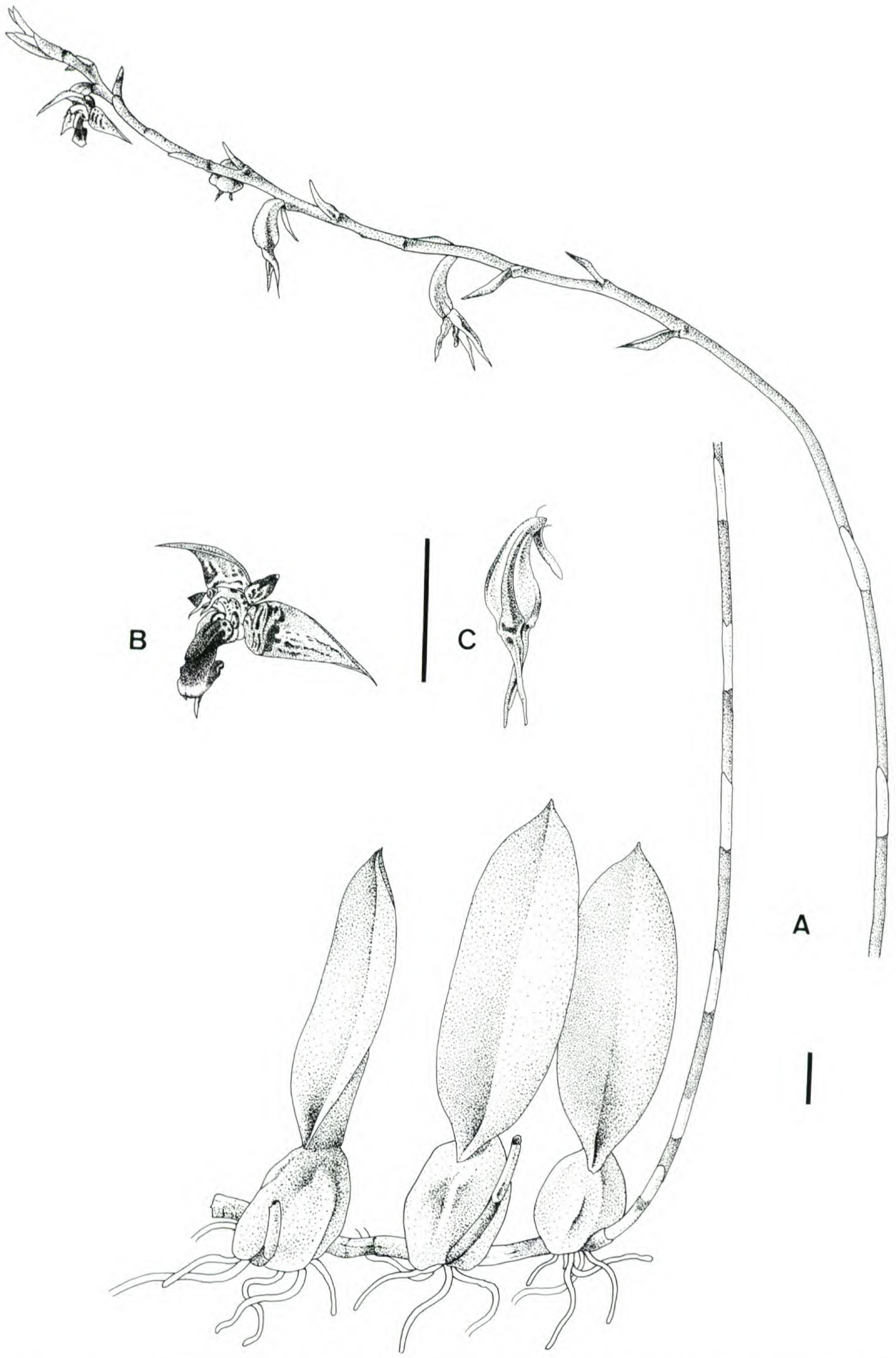


Figure 1. *Bulbophyllum involutum* Borba, Semir & F. Barros. —A. Habit and inflorescence. —B. Flower. —C. Ripe unopened fruit. Scale bars = 1 cm. Drawn from cultivated specimen by Eduardo H. P. Kickhöfel.

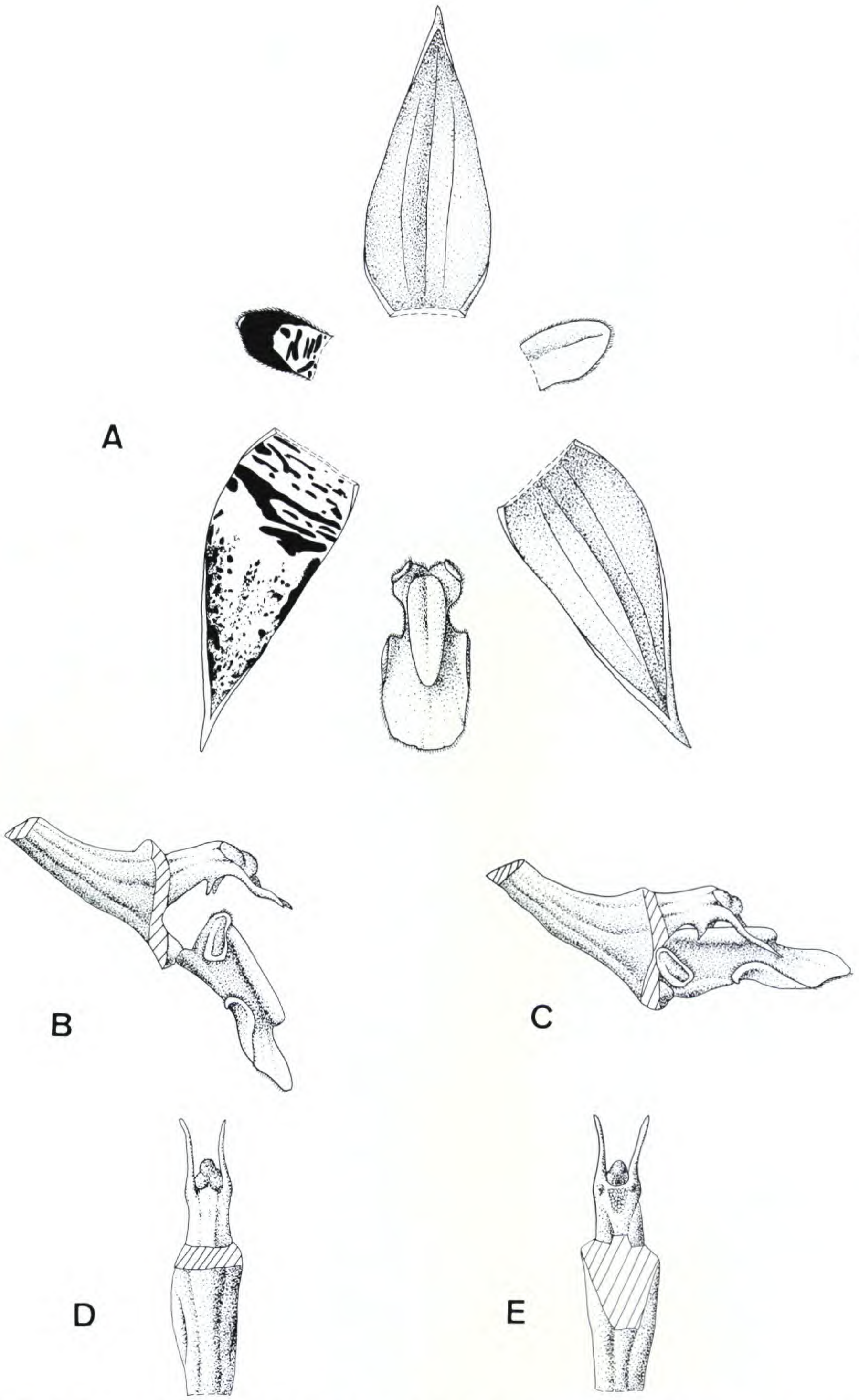


Figure 2. *Bulbophyllum involutum.* —A. Perianth parts; left petal and sepal showing the color pattern of purple spots and points. —B. Ovary, column, and labellum, side view; normal position. —C. Ovary, column, and labellum, side view; labellum bent by the wind against the column. —D. Ovary and column, upper view. —E. Ovary and column, lower view. Scale bar = 5 mm. Drawn from cultivated specimen by Eduardo H. P. Kickhöfel.

sinuate arms or stelidia and two falcate teeth on the ventral face; anther versatile, green, papillose, two pollinia-pairs. Capsule 8.5–12.1 × 6.1–9.4 mm.

Distribution. *Bulbophyllum involutum* grows on rocks or sometimes on trees in the campos rupestres of the states of Minas Gerais and Bahia, along the Espinhaço range. The southern limit of its distribution is São Gonçalo do Rio Abaixo, in Minas Gerais, where it grows on the granite rocks of the foothills of the Espinhaço range, extending to the north along the quartzitic formations of the Serra do Cipó, Diamantina, and Serra de Grão-Mogol, in Minas Gerais, until it reaches Pico das Almas and Mucugê, in Bahia.

In the field, *Bulbophyllum involutum* is easily recognized by its purple inflorescence (flowers, bracts, scape, and rachis), always with a single flower at anthesis, while *B. warmingianum*, *B. longispicatum*, and *B. ipanemensis* have green or greenish yellow inflorescences, with three to five flowers simultaneously at anthesis, as can be seen in the colored plates and descriptions of these species (Warming, 1883; Cogniaux, 1902; Hoehne, 1938). Those traits also aid in the recognition of *B. involutum* in herbarium material, since the purple coloration remains in its sepals, scape, and bracts.

In lip characters *Bulbophyllum involutum* is very close to *B. warmingianum*, while *B. ipanemensis* has a very convex mid-lobe with an attenuated base, and *B. longispicatum* has a long and membranaceous mid-lobe and a callus that is not sulcate. The shape of the petals, ovate with an obtuse apex, is very peculiar compared with those of the other two species, which are always triangular with an acute apex.

Studies of floral biology, both in the field and greenhouse (Borba & Semir, in press), support the establishment of *B. involutum* as a separate species, since some specificity of pollinators occurs at least between this species and *B. ipanemensis*. This could be due to the different composition of odors producing volatile compounds in these two species (Silva et al., in press), which certainly play an important role in the attraction of the pollinators.

Having a single flower in anthesis at a time is a uniform character among the populations studied, observed in all examined individuals of this species (over 150). It also affects the rate and type of sexual reproduction when compared to the other species studied (Borba & Semir, in press).

Like the other *Bulbophyllum* species, *B. involutum* presents an extremely moveable labellum, which is easily bent by the wind against the column. In this species this bending plays an essential role in pollination, trapping the insect (females of *Pholeomyia*, Diptera: Milichiidae) in the column (Sazima, 1978, identified as *B. warmingianum*; Borba & Semir, in press).

Paratypes. BRAZIL. **Minas Gerais:** Diamantina, Serra da Samambaia, 7 Apr. 1980 (fl), *F. Barros 171* (SP); estrada Diamantina/Mendanha, km 585, 6 June 1985 (fl), *H. F. Leitão-Filho 17523* (UEC); Santana do Riacho, Parque Nacional da Serra do Cipó, 3 Feb. 1994 (fl), *E. L. Borba 100* (BHCB); Santana do Riacho, Parque Nacional da Serra do Cipó, região do Congonhas, 900 m, May 1995 (fl), *E. L. Borba 150* (MO, UEC); Santana do Riacho, Serra do Cipó, rio Santo Antônio, 500 m, 27 Apr. 1978 (fl), *G. Martinelli 4412* (RB); Santana do Riacho, Serra do Cipó, km 100, 1000 m, 27 Apr. 1978 (fl), *G. Martinelli 4364* (RB); Conceição do Mato Dentro, Serra do Cipó, km 129, Rio Santo Antônio, 1300 m, 16 July 1977 (fl), *G. Martinelli & A. Távora 2611* (RB); Serra do Cipó, 2 May 1973 (fl), *M. Sazima* (HB herbarium #59402); Grão-Mogol, Vale do Riacho Ribeirão, 900 m, 24 May 1987 (fl), *R. Mello-Silva & J. R. Pirani [CFCR 10866]* (SPF); estrada Grão-Mogol/Montes Claros, 16 Apr. 1981 (fl), *L. Rossi [CFCR 1025]* (SPF, SP). **Bahia:** Mucugê, estrada Mucugê/Cascavel, km 3 a 6, próximo ao rio Paraguaçu, 20 Sep. 1981 (fl), *N. L. Menezes et al. [CFCR 1477]* (SPF, SP); Rio de Contas, Chapada Diamantina, Vale do Queiroz, Pico das Almas, col. in 16 Sep. 1995 and cultivated until flowering in July 1996, *I. Koch & R. Lengruber 452* (UEC).

Acknowledgments. Thanks are due to "Fundação de Apoio ao Ensino e à Pesquisa (FAEP-UNICAMP)" for financial support (project #931/95), to IBAMA for giving us permission to collect in "Parque Nacional da Serra do Cipó," and to CEMIG for permission to collect in "Estação de Pesquisa e Desenvolvimento Ambiental de Peti." We also thank Ingrid Koch for the gift of living specimens of *B. involutum*, Graziela M. Barroso and Eduardo H. P. Kickhöfel for the Latin diagnosis and illustrations (E. Kickhöfel), and Marlene M. Leite, George J. Shepherd, Julie H. A. Dutilh, and two anonymous reviewers for suggestions and help with English.

Literature Cited

Borba, E. L. & Semir, J. In press. Wind-assisted fly pollination in three *Bulbophyllum* (Orchidaceae) species occurring in the Brazilian "campos rupestres." Lindleyana.

Cogniaux, A. 1902. Orchidaceae. Pp. 1–664 *in* C. F. P. Martius & A. G. Eichler (editors), Flora Brasiliensis, Vol. 3(5). Frid. Fleischer, Lipsiae.

Dressler, R. L. 1993. Phylogeny and Classification of the Orchid Family. Cambridge Univ. Press, Cambridge.

Hoehne, F. C. 1938. Cincoenta e uma novas espécies da flora do Brasil e outras descrições e ilustrações. Arq. Bot. Estado São Paulo 1(1): 1–38.

Pabst, G. F. J. & F. Dungs. 1975. Orchidaceae Brasiliensis, Vol. 1. Kurt Schmersow, Hildesheim.

——— & ———. 1977. Orchidaceae Brasiliensis, Vol. 2. Kurt Schmersow, Hildesheim.

Sazima, M. 1978. Polinização por moscas em *Bulbophyl-*

lum warmingianum Cogn. (Orchidaceae), na Serra do Cipó, Minas Gerais, Brasil. Revista Brasil. Bot. 1: 133–138.

Silva, U. F., E. L. Borba, J. Semir & A. J. Marsaioli. In press. A simple solid injection device for the analyses of *Bulbophyllum* (Orchidaceae) volatile compounds. Phytochemistry.

Warming, E. 1883. Symbolae ad floram Brasiliae centralis cognoscendam, Vol. 29. Bianco Luno, Copenhagen.

Two New Combinations in *Madhuca* (Sapotaceae)

Pranom Chantaranothai
Department of Biology, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

ABSTRACT. Two new combinations are made in *Madhuca*: *M. krabiensis* (Aubréville) P. Chantaranothai and *M. lecomtei* (Aubréville) P. Chantaranothai.

In preparing a treatment of the Sapotaceae for the *Flora of Thailand*, it became clear to the author that two new combinations in *Madhuca* were needed.

Madhuca krabiensis (Aubréville) P. Chantaranothai, comb. nov. Basionym: *Aesandra krabiensis* Aubréville, Dansk Bot. Ark. 23(4): 519. 1968. *Diploknema krabiensis* (Aubréville) Pennington, Gen. Sapot. 164. 1991. TYPE: Thailand. Krabi, Laem Nang, *B. Hansen & T. Smitinand 12352* (holotype, C; isotypes, BKF, K).

In the holotype specimen, the flower has 4 sepals, although two flowers have 5 and one has 6, and they are always arranged in two whorls; the aestivation of the corolla lobes is either contorted or imbricate. Based on this and the examination of additional specimens, this species belongs to *Madhuca*. It appears to be most closely related to the Malaysian species, *M. ridleyi* H. J. Lam, which is very similar in the form of the flowers and leaves. *Madhuca krabiensis* is distinguished from *M. ridleyi* by the pubescence on the ovary and between the stamens, and the slightly retuse and deflexed leaf apices.

Additional specimens examined. THAILAND. Krabi, Khao Chong Lad, *S. Suthesorn 891* (BK); Phangnga, Khao Ping Gan, *Rollet s.n.* (BKF); Chumphon, Langsuan, Tha Chana, *T. Smitinand 12125* (BKF).

Madhuca lecomtei (Aubréville) P. Chantaranothai, comb. nov. Basionym: *Aesandra lecomtei* Aubréville, Fl. Cambodge, Laos et Vietnam, Sapotacées 21. pl. 2, f. 4–7. 1963. TYPE: Cambodia. Kank-longeang, *Service Forestier 36942* (holotype, P).

Madhuca lecomtei does not have the uniseriate calyx, the most important character to distinguish *Aesandra* (= *Diploknema*) from *Madhuca*. This species is related to a Thai *Madhuca, M. stipulacea* H. R. Fletcher, from which it differs by having pale yellowish brown pubescence on the calyx and longer corolla lobes and filaments.

Acknowledgments. I thank the Swedish Institute for financial assistance enabling me to undertake this study at the Naturhistoriska Rikmuseet, Stockholm, and the Programme for Biodiversity Research and Training, Thailand (TRF-NSTDA/BIOTEC), for support for travel costs. I am thankful to Jens Klackenberg for helpful comments on the manuscript. I also thank the directors of A, AAU, ABD, BKF, BM, C, E, K, L, P, PSU, and S for providing herbarium facilities and loan of materials.

A New Species of *Rustia* (Rubiaceae, Rondeletieae) from Bilsa Biological Station, Esmeralda Province, Ecuador

Piero G. Delprete

Institute of Systematic Botany, The New York Botanical Garden, Bronx, New York 10458-5126, U.S.A.

ABSTRACT. A new species of *Rustia* from Ecuador (Esmeraldas Province), *R. bilsana*, is described and illustrated. The new species is represented by trees endemic to the cloud forests of northwestern Ecuador, and is easily recognizable by having floral buds pointed at the apex, capsules widely obovoid, inflorescences 16–26 cm long, and purple corollas.

RESUMEN. Se describe e ilustra una nueva especie de *Rustia* del Ecuador (Provincia de Esmeraldas), *R. bilsana*. La nueva especie está representada por árboles endémicos de los bosques nublados del Noroeste del Ecuador, y es fácilmente distinguible por sus botones florales agudos, cápsulas anchamente obovoides, inflorescencias 16–26 cm de largo y corolas color púrpura.

Rustia is a genus of approximately 14 species of shrubs and trees, ranging from Costa Rica to southern Brazil. This genus is unique in having terminally poricidal anthers and pellucid-punctate leaves. Its sister genus, *Tresanthera*, is represented by trees endemic to the coastal forests of Venezuela and Trinidad and Tobago; it also has pellucid-punctate leaves but has laterally poricidal anthers. A full monographic treatment of *Rustia* is given by Delprete (in press–1999), and an account of the species present in Ecuador has been prepared by Delprete (1998). *Rustia* and *Tresanthera* have traditionally been placed in the tribe Condamineeae, but this tribe has been shown to be paraphyletic (Delprete, 1996b), and both genera are included in the tentatively delimited tribe Rondeletieae (Delprete, 1996b).

Ecuador has the highest number of species of *Rustia* (6 out of a total of 14), representing the center of diversity for this genus. The high degree of biodiversity in Ecuador is correlated with the varied vegetational zones present in the country, the adaptation of the species to certain ecological niches, and the latitude being near the equator. In the case of *Rustia*, one species (*R. occidentalis* (Bentham) Hemsley) is a shrub endemic to coastal swamps, two are trees found in the wet forests of the western slopes of the Andes (*R. alba* Delprete from Carci Province and *R. bilsana* Delprete described below, from Esmeralda Province) and the remaining three (*R. schunkeana* Delprete, *R. viridiflora* Delprete, and *R. rubra* Standley ex D. Simpson) are trees occurring on the forested slopes of the Amazonian region.

During routine identification of Rubiaceae from Ecuador, while I was still a doctoral student at the University of Texas at Austin in fall 1995, a specimen (*Clark, Bass & Pitman 139*) of *Rustia* caught my attention. It was collected at the Bilsa Biological Station, and it was clearly an undescribed species of this genus. Several other species of *Rustia* occurring in Ecuador have recently been described (Delprete, 1995, 1996a), and the taxonomic position of the genus has been analyzed (Delprete, 1996b). The only specimen (*Clark et al. 139*) known to me in fall 1995 had inflorescences with only a few old flowers and immature fruits. One year later, John Clark returned to the original site in order to provide complete herbarium specimens (*Clark 2979*), pickled flowers for morphological studies, and photographs (see Fig. 2). The new species is still known only from the Bilsa Biological Station.

The Bilsa Biological Station is a nature preserve of approximately 2500 ha, with an altitudinal range from 300 to 800 m and is located in the Mache Mountains portion of the northwestern province of Esmeraldas. Bilsa was founded in 1994 by the Jatun Sacha Foundation in memory of the late biologists Al Gentry (botanist) and Ted Parker (ornithologist), who died in an airplane crash in the Ecuadorian mountains. This reserve represents one of the few remnant patches of premontane wet forest in northwestern South America, of which less than 1% remains. This premontane forest ecosystem is extremely endangered and quickly disappearing due to farming practices and indiscriminate logging. The Bilsa reserve houses a unique composition of flora and fauna, with elements related to both the coastal rainforest of Colombian Chocó Province and Andean cloud forests, and many of its species are rare or still unknown to science. The

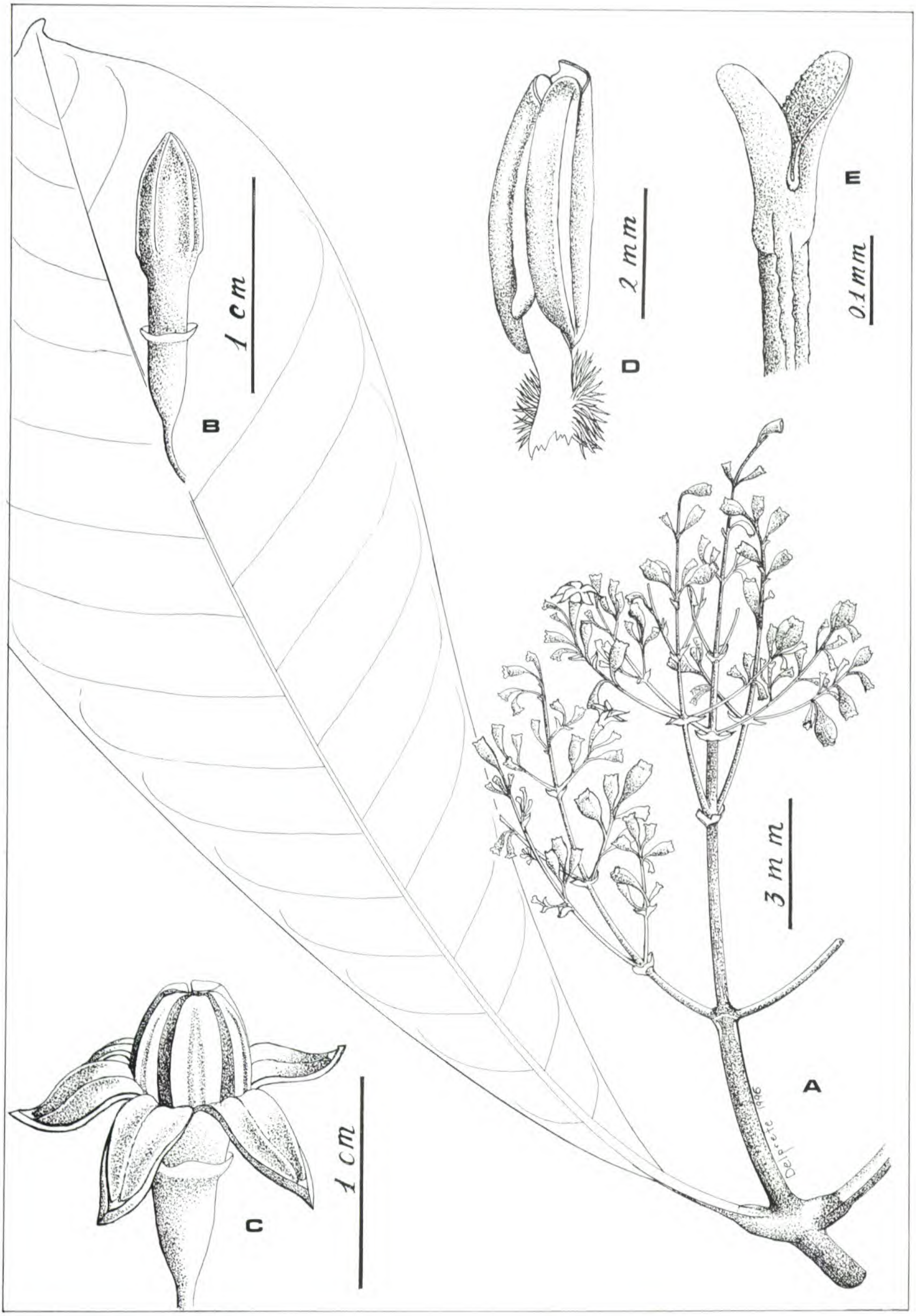
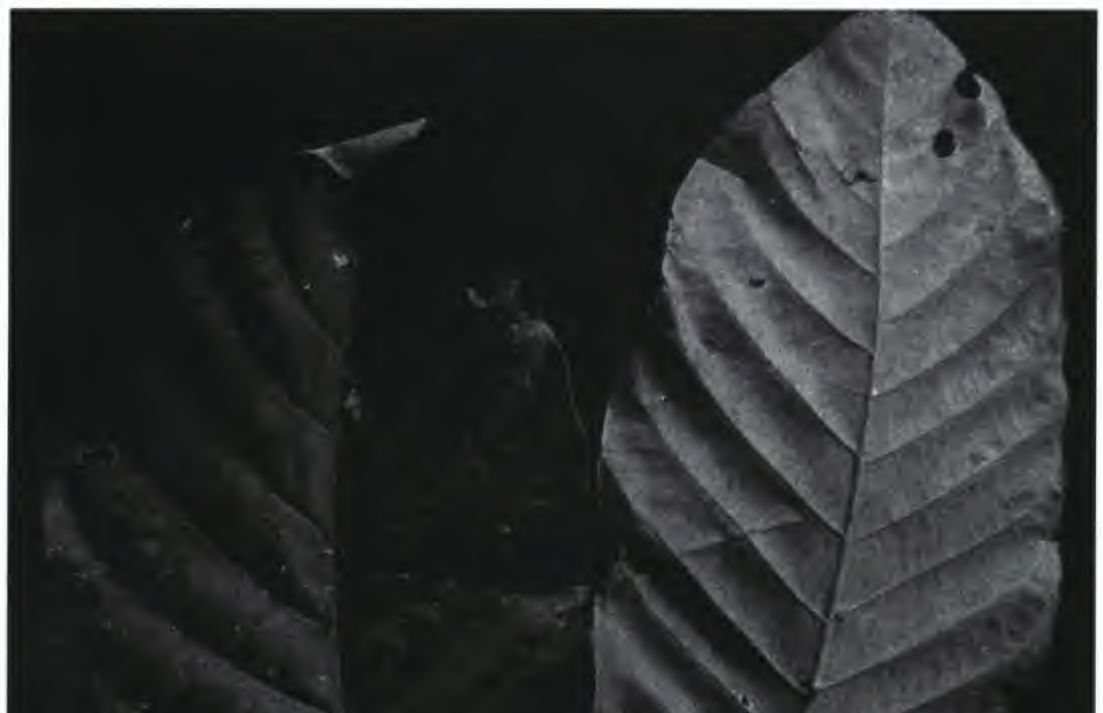


Figure 1. *Rustia bilsana* Delprete. —A. Habit of inflorescence with mature leaf. —B. Flower bud (note pointed apex and reduced calyx). —C. Flower in early stage of anthesis. —D. Anther. —E. Style. (Drawn from slides and type specimens: *Clark 2979.*)



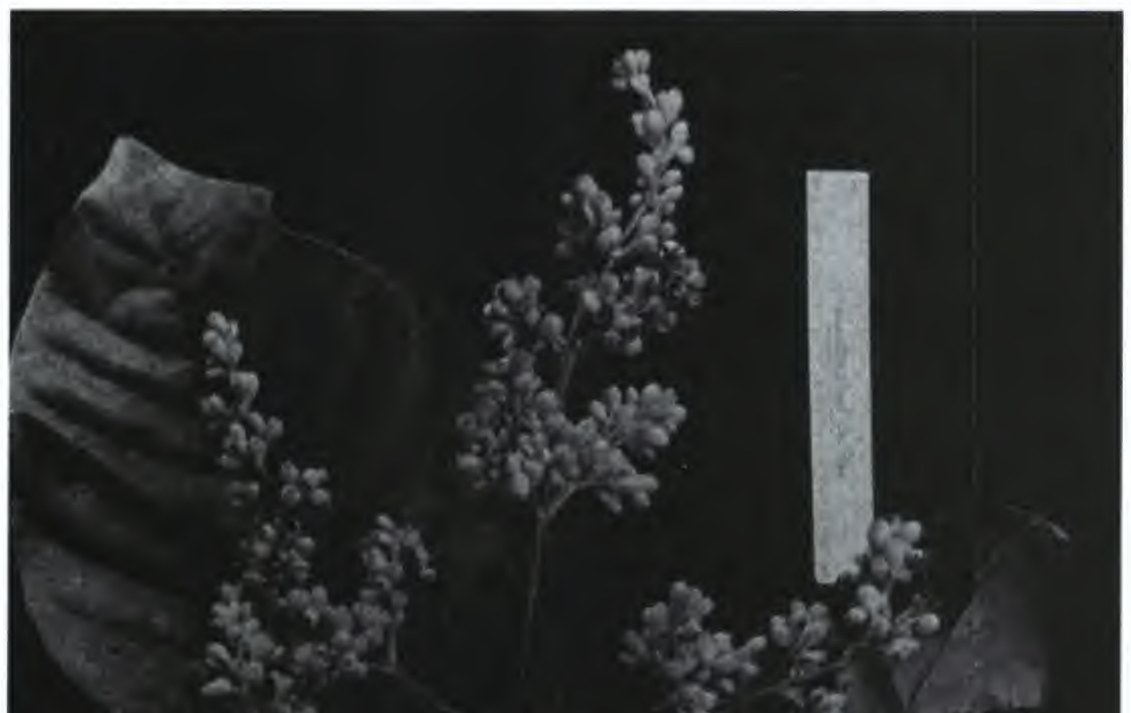


Figure 2. *Rustia bilsana*. —A, B. Inflorescences of two specimens collected (*Clark 2979*) from the same tree (note the variation in size). —C. Stipules. —D. Detail of inflorescence branches with flowers in anthesis and immature fruits. —E. Close-up of the tip of an inflorescence branch, with flower buds and two open flowers, one in early stage of anthesis (top) and the other in later stage (below). Photos taken by John Clark.

arboreal species described below is one clear example of Bilsa's poorly studied biodiversity.

Rustia bilsana Delprete, sp. nov. TYPE: Ecuador. Esmeraldas: Cantón Quinindé, Bilsa Biological Station, Mache Mountains, 35 km W of Quinindé, 5 km W of Santa Isabel, along Cube River, premontane wet forest, 0°21′N, 79°44′W, 500 m, 2 Oct. 1996, *J. L. Clark 2979* (holotype, QCNE; isotypes, AAU, CAS, COL, DAV, F, G, GB, GH, MO, NY, P, QCA, TEX, US). Figures 1, 2.

Arbor 19 m usque alta, ramis juvenilibus glabris; lamina oblanceolata, ad basin acuta, ad apicem rotunda acuminata, nervis lateralibus 15–18-paribus; domatia desunt; inflorescentiae paniculae pyramidales, 16–26 cm; gemma floris ad apicem acuminata; capsula late obovoidea, 7–8 × 6.0–6.5 mm, glabra; semina 0.6–1.2 × 0.3–0.5 mm.

Tree to 19 m tall, and to 47.5 cm diam. Young branches glabrous. Stipules narrowly triangular, 23–28 mm long, 6–8 mm wide at base, glabrous throughout, with a few colleters at base inside. Leaves 33–55 × 13–21 cm, oblanceolate (length/width 2.5:1), acute-decurrent at base, rounded and short-acuminate at apex, thick-chartaceous, glabrous above and below, secondary veins 15–18 pairs, faintly evident above and below; domatia absent; petioles 2.0–2.5 cm long. Inflorescences laxly paniculate and pyramidal, 16–26 cm long, the basal branches 9–12 cm long, the lateral branches 4–5 pairs. Flower pedicels 1–2 mm long, glabrous; flower buds cylindrical and pointed at apex; calyx 0.5–1.0 mm long, reduced to a wavy margin with barely distinguishable lobes, persistent. Corolla tubular with a basal constriction and reflexed lobes, 0.8–0.9 cm long, purple, semi-fleshy; tube 3.5–4.0 mm long, glabrous outside and inside; lobes 5.0–5.5 mm long, narrowly triangular and reflexed, glabrous outside and microscopically (40×) papillose at margins inside; lobes ⅔ of corolla length. Filaments attached ca. 4 mm from the base of the tube, 2 mm long, flattened and widened at base, with a tuft of antrorse and retrorse strigose hairs; anthers convex toward the center and rounded at base, 4.1–4.4 × 1.2–1.3 mm, dorsifixed near the base (thecae equal at base); style 9–11 mm long, glabrous, the stigmatic lobes ca. 1.5 mm long. Capsules widely obovoid, 7–8 × 6.0–6.5 mm, smooth (without lenticels); capsule and disk glabrous. Seeds 0.6–1.2 × 0.3–0.5 mm.

Rustia bilsana (Figs. 1, 2) is similar to *R. alba*, from cloud forests at 1500–1700 m elevation in northwestern Ecuador, in having floral buds pointed at the apex and widely obovoid capsules. The former differs from the latter in having leaves oblanceolate (vs. widely obovate), acute-decurrent at base (vs. acute-rounded); inflorescence 16–26 cm long (vs. 30–46 cm long); calyx reduced and with wavy margin (vs. cupular and with small lobes); corolla purple and 8–9 mm long (vs. white and 15–19 mm long); corolla lobes 5.0–5.5 mm long (vs. 9–11 mm long), glabrous inside (vs. densely ascending short-strigose at base); anthers half-exserted (vs. fully exserted and pendulous); style 9–11 mm long (vs. 16–20 mm long); style branches 1.5 mm long (vs. 3.0–3.5 mm long); capsules 7–8 mm long (vs. 8–12 mm long); and seeds 0.6–1.2 × 0.3–0.5 mm (vs. 2.25–2.90 × 0.65–0.95 mm).

This species is similar to *Rustia occidentalis* in having fleshy purple flowers, but differs from it in being a tall tree growing at medium elevations (vs. shrubs growing in lowland swampy areas), in having smaller flowers, flower buds pointed at the apex (vs. clavate), bigger and more branched inflorescences, and smaller capsules.

Paratype. ECUADOR. **Esmeraldas:** Cantón Quinindé, Bilsa Biological Station, Mache Mountains, 35 km W of Quinindé, 5 km W of Santa Isabel, premontane wet forest, 0°21′N, 79°44′W, 400–600 m, 3 Oct. 1994, *Clark, Bass & Pitman 139* (MO, QCA, QCNE, TEX).

Acknowledgments. I am grateful to Charlotte Taylor for sending me the original material of *Rustia* (*Clark et al. 139*) for identification, and to her, David Lorence, and Michael Nee for reviewing the present article and for helpful comments. I am also thankful to Rupert Barneby for help with the Latin diagnosis, and to Alberto Areces for help with the abstract in Spanish. The description of this species would have not been possible without the careful collections and detailed photographs made by John Clark, ex-U.S. Peace Corps volunteer and botanical collector based at Bilsa Biological Station. The line drawing is provided by the author.

Literature Cited

Delprete, P. G. 1995. Three new species of *Rustia* (Rubiaceae, Condamineeae) from Panama and Ecuador. Novon 5: 133–139.

———. 1996a. Studies on pendulous flowered species of Rustia (Rubiaceae, Condamineeae), including a new species, *Rustia schunkeana*. Brittonia 48: 29–34.

———. 1996b. Evaluation of the tribes Chiococceae, Condamineeae and Catesbaeeae (Rubiaceae) based on morphological characters. Opera Bot. Belg. 7: 165–192.

———. 1998. Rubiaceae–Condamineeae. *In:* G. Harling & L. Andersson, Flora of Ecuador (in press).

———. 1999. Rondeletieae (Rubiaceae), part I. Flora Neotropica Monographs, vol. 77 (in press).

Cardiospermum cuchujaquense (Sapindaceae), a New Species from Sonora, Mexico

María S. Ferrucci
Instituto de Botánica del Nordeste, C.C. 209, 3400, Corrientes, Argentina

Pedro Acevedo-Rodríguez
Smithsonian Institution, Dept. of Botany, National Museum of Natural History, NHB-166, Washington, D.C. 20560, U.S.A.

ABSTRACT. A new species, *Cardiospermum cuchujaquense* from Sonora, Mexico, is described and illustrated. The new species belongs to *C.* sect. *Carphospermum*, which is characterized by the presence of chaffy or scaly trichomes. With the discovery of *C. cuchujaquense*, a pattern of disjunct distribution is documented for *C.* sect. *Carphospermum*.

RESUMEN. En el presente artículo se describe y se ilustra una nueva especie de *Cardiospermum* (*C. cuchujaquense*), la cual pertenece a *C.* sección *Carphospermum*. Mediante el descubrimiento de esta nueva especie se documenta un patrón de disyunción en la distribución de la sección *Carphospermum*.

Cardiospermum L. contains approximately 15 species of herbaceous vines or less often subshrubs. It belongs to the largely neotropical tribe Paullinieae (Sapindaceae) along with five other genera (*Serjania* Miller, *Paullinia* L., *Urvillea* Kunth, *Houssayanthus* Hunziker, and *Lophostigma* Radlkofer, Acevedo-Rdgz., 1993: 31). Among these genera *Urvillea* is the closest to *Cardiospermum*, since they share numerous synapomorphic characters. In fact, both genera are so closely related that sometimes they are hard to tell apart. However, as a rule, *Cardiospermum* has inflated capsules that differ from the non-inflated capsules of *Urvillea*.

Cardiospermum occurs throughout the Neotropics, with centers of distribution in west-central Brazil and north-central Mexico. It is the only genus within the Paullinieae with three of its species having a nearly cosmopolitan distribution. The only other member of Paullinieae to occur naturally outside the Western Hemisphere is *Paullinia pinnata* L., which is also found in tropical Africa (Exell, 1966; Fouilloy & Hallé, 1973). Although *Cardiospermum* is a relatively small genus, it is perhaps one of the most heterogeneous within the Paullinieae. *Cardiospermum* is also cytologically diverse, since different chromosome numbers have been reported among the few species analyzed (Ferrucci, 1981).

Recent botanical explorations for the ongoing project *Flora of the Río Mayo Region of Sonora* have yielded the discovery of a new species of *Cardiospermum*, which we herein describe.

Cardiospermum cuchujaquense M. S. Ferrucci & P. Acevedo-Rodríguez, sp. nov. TYPE: Mexico. Sonora: El Ranchería, crossing of Río Cuchujaqui, ca. 22.5 km S of Alamos on road to El Chinal, 26°51′N, 108°55′W, 200 m, in tropical deciduous forest, 10 Oct. 1992 (fl, fr), *T. R. Van Devender, R. K. Van Devender, A. C. Sanders & B. Pitzer 92-1178* (holotype, US; isotypes, ARIZ, CTES, MEXU). Figures 1, 2.

Suffrutex scandens, subglaber; caule 6-costato, corpore lignoso simplici. Folia stipulis linearibus, 2.5–5 mm longis, acuminatis; folia trifoliolata, foliolis ovatis vel lanceolatis, 3.3–5.8 cm longis, chartaceis, sparsim setulosis, apice longe-acuminatis, margine inciso-dentatis vel lobatis; foliolo terminali basi longe-attenuato, foliolis lateralibus basi cuneatis. Capsula alata, septifraga, chartacea, ambitu trigono-obovato, loculis centraliter inflatis, extus glabris praeter venam dorsalem trichomatibus laxis indutam, intus glabris; seminibus subglobosis, 4.5–5.2 mm diam., trichomatibus paleaceis indutis, arillodio cordiformi.

Climbing shrub to 3.5 m long; stems herbaceous, 1–1.5 mm diam., 6-ribbed to nearly terete, pilose, sometimes with scattered minute glandular trichomes; cross section of stem with a single stele. Stipules linear 2.5–5 mm long, pilose, falcate and usually reflexed, acuminate at apex; leaves trifoliolate; petiole pilose, 1.3–3.7 cm long, furrowed along adaxial surface; leaflets nearly sessile, ovate to lanceolate, often 1–2-lobed, 3.3–5.8 × 1.5–3.3 cm, chartaceous, concolorous, sparsely setulose, especially along veins and abaxial surface, the apex long acuminate, usually glandular, the margins remotely glandular-serrate, the terminal leaflet with a long attenuate base, the base of lateral ones asymmetric with a narrower acroscopic side, cuneate at

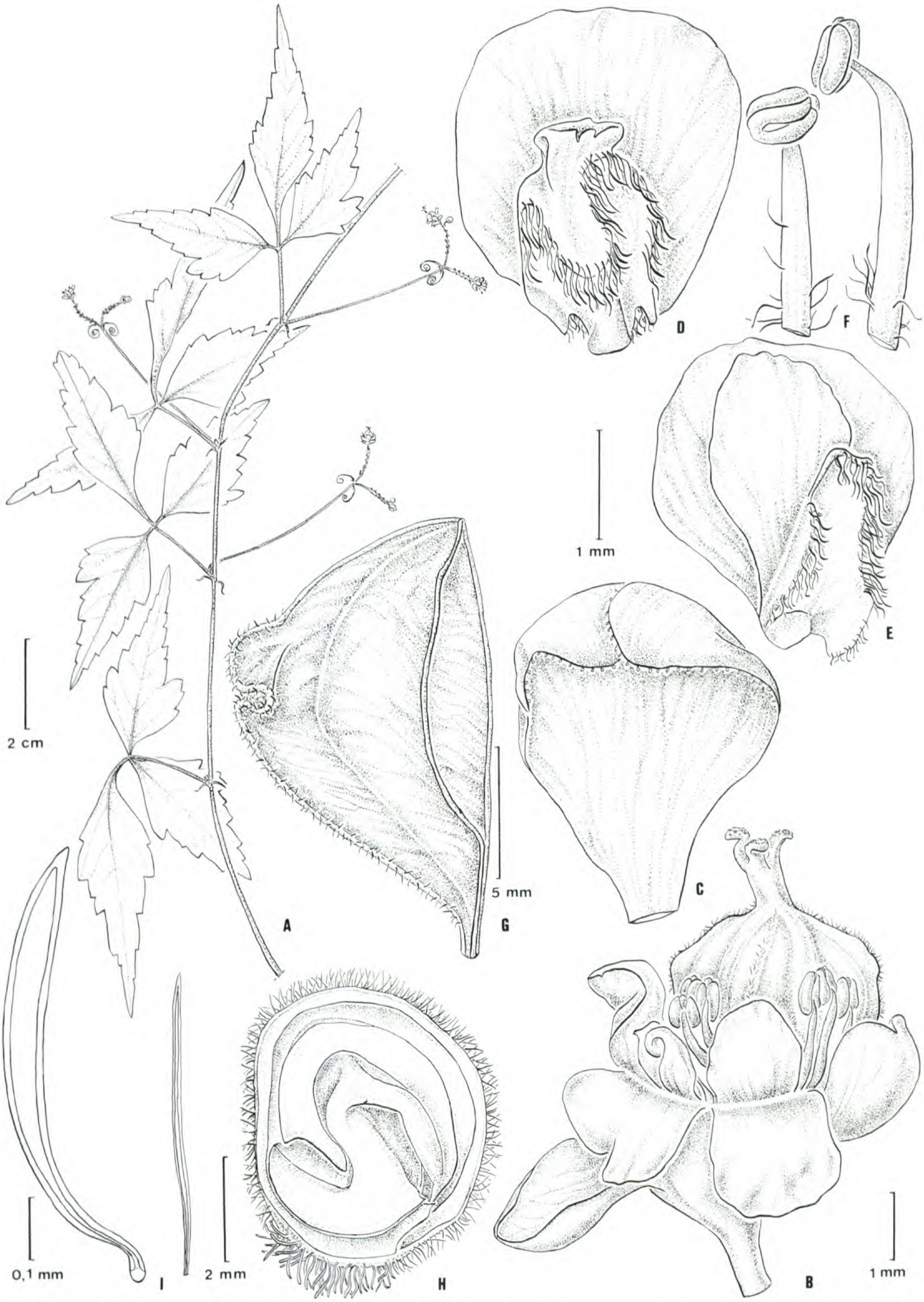


Figure 1. *Cardiospermum cuchujaquense* M. S. Ferrucci & P. Acevedo-Rodríguez. —A. Portion of flowering branch. —B. Pistillate flower. —C. Detail of third and fifth connate sepals. —D. Central petal with adnate appendage. —E. Lateral petal with adnate appendage. —F. Stamens from staminate flower. —G. Fragment of fruit coccus, without partitioning wall. —H. Longitudinal section of seed showing embryo. —I. Seed trichomes. All from *T. R. Van Devender et al. 92-1178.*

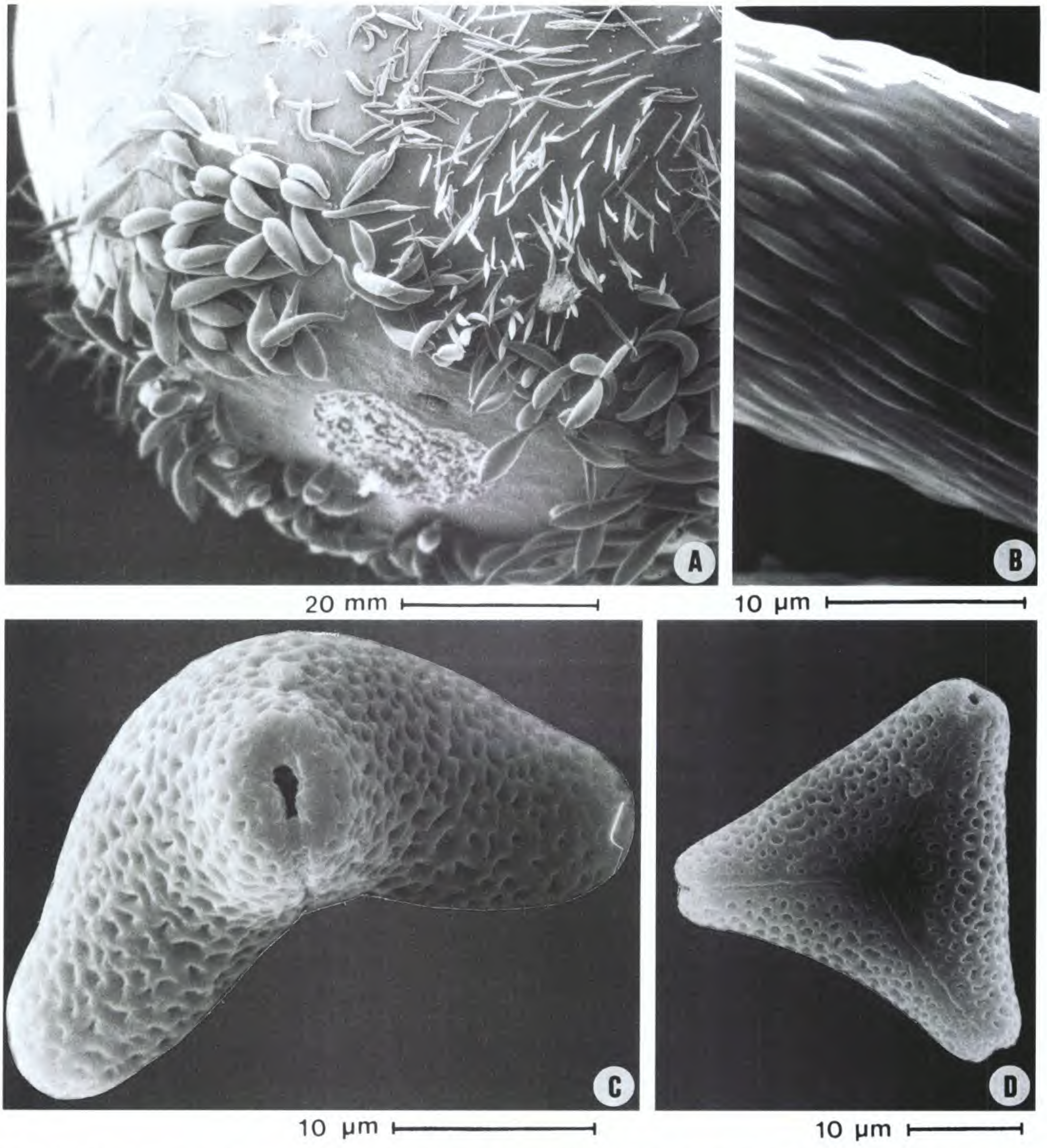


Figure 2. *Cardiospermum cuchujaquense*. —A. Arillar portion of seed, showing hylum, micropile, and fusiform and paleaceous trichomes. —B. Detail of paleaceous hair. —C. Pollen grain, equatorial view. —D. Pollen grain, polar view. All from *T. R. Van Devender et al. 92-1178*.

base. Thyrses axillary, simple, as long as or shorter than subtending leaf; axis 4-angled, pilose, 1.6–6 cm long, with a pair of delicate tendrils just below insertion of cincinni; bracts and bracteoles deltate to elliptic, ca. 1.5 mm long, overlapping, reddish tinged, pilose at margins; cincinni (1–)2(3–4), distal on axis, 2–20-flowered, 5–8 mm long; pedicels 1.5–2 mm long, articulated at middle; flowers secund. Pistillate flowers slightly larger than staminate ones: sepals green, 5, glabrous, glandular at margins, the outer 2 sepals ca. 1.5 × 1.2–1.9 mm, suborbicular, the inner sepals 3–5 × 1.5–2.6 mm, obovate, third and fifth sepals connate through ¾ of their length; petals white, 3–3.2 mm long, broadly obovate, densely papillate on adaxial surface, the apex rounded; appendages of central petals hood-shaped, with fleshy entire apex; disk with four glands, the central glands ovoid with obtuse apex, the lateral glands with circular outline; torus enlarged, glabrous; filaments terete, pilose to glabrous, 2–2.7 mm long in staminate flowers, 1–2 mm long in pistillate flowers, the anthers oblong, ca. 0.5

mm long, glabrous; pistillode glabrous; gynoecium obovate in outline, ca. 5 mm long, pilose; style ca. 0.6 mm long. Capsule 3-carpellate, trigonous-obovoid, chartaceous, 1.4–1.6 × 2.0–2.2 cm, with narrow partitioning walls; coccus slightly inflated, with dorsal suture pilose and compressed into a narrow wing; endocarp glabrous; seeds nearly spherical, 4.5–5.2 mm diam.; seed coat covered with chaffy trichomes; arillode heart-shaped, dry, light brown, ca. 2.6 × 1.7 mm with fusiform orange-brown trichomes; embryo with biplicate, smaller, adaxial cotyledon and curved, larger, abaxial cotyledon. Pollen grains hemitrisyncolporate, peroblate, polar axis 10.48–15.72 μm, equatorial diam. 32.09–37.99 μm.

Distribution and habitat. Known only from the state of Sonora, Mexico, in tropical deciduous forest and on rocky ledges of gorges.

Cardiospermum cuchujaquense is placed in *Cardiospermum* sect. *Carphospermum* Radlkofer because of its seeds bearing chaffy (paleaceous) trichomes, a character defining the section (Radlkofer, 1932: 372). On the basis of this character, *C. cuchujaquense* is taken as being closely related to the Brazilian species *C. anomalum* Cambessèdes and *C. strictum* Radlkofer, the only other members of section *Carphospermum* (Radlkofer, 1932: 412). *Cardiospermum cuchujaquense*, however, differs from these two species by its climbing, elongated (> 1 m long) stems (vs. erect, self-supporting, 15–50 cm tall); the presence of watch-spring-like tendrils (vs. tendrils absent); its stipules 2.5–5 mm long (vs. stipules ca. 0.5 mm long); by its flowers with a 5-merous calyx and a 4-glandular nectary disk (vs. 4-merous calyx and a 2-glandular nectary disk); and its hemispherical seeds (vs. laterally flattened). The specific epithet refers to the locality where the species has been collected.

Paratypes. MEXICO. **Sonora:** Arroyo el Mentidero at El Chinal road, 11.3 km S of Alamos, 26°54′45″N, 108°55′05″W, 240 m, 6 Oct. 1992 (fl), *T. R. Van Devender et al. 92-1012* (ARIZ, UCR, US); on rocky ledge in canyon wall, 28 Oct. 1995 (fl), *T. R. Van Devender et al. 95-1171* (ARIZ, CTES, MEXU).

Acknowledgments. We thank Tom R. Van Devender (ARIZ) for his efforts in providing representative material for describing this new species. This included not only the collection of materials in the field, but also his efforts in cultivating the plants in order to provide young stages for chromosome counting. We also thank John F. Wiens of the Arizona Sonora Desert Museum for his detailed description of the plants grown at their greenhouse from seeds collected from the type locality. We also extend our appreciation to Liliana Gómez (CTES) for preparing the illustration, and to John Pruski (US), Mark T. Strong (US), and an anonymous referee for reviewing the manuscript.

Literature Cited

Acevedo-Rdgz., P. 1993. Systematics of *Serjania* (Sapindaceae). Part I: A revision of *Serjania* sect. *Platycoccus*. Mem. New York Bot. Gard. 67: 1–93.

Exell, A. W. 1966. Sapindaceae. *In*: A. W. Exell, A. Fernandes & H. Wild (editors), Flora Zambesiaca 2: 494–543. Crown Agents for Oversea Governments and Administrations, London.

Ferrucci, M. S. 1981. Recuentos cromosómicos en Sapindaceas. Bonplandia 5(11): 73–81.

Fouilloy, R. & N. Hallé. 1973. Sapindacées. *In:* A. Aubréville & J. F. Leroy (editors), Flore du Gabon 23: 1–202. Muséum National d'Histoire Naturelle, Paris.

Radlkofer, L. 1932. Sapindaceae. *In:* A. Engler, Pflanzenreich IV. 165(Heft 98b): 321–640. Wilhelm Engelman, Leipzig.

A New Species of *Ditassa* (Asclepiadaceae) from Espírito Santo, Brazil

Jorge Fontella Pereira and Miriam Cristina Alvarez Pereira
Herbarium Bradeanum, CP 15005, Rio de Janeiro, RJ, CEP 20031-970, Brazil

ABSTRACT. *Ditassa oberdanii*, a new species of Asclepiadaceae from remnant patches of Atlantic rainforest in Espírito Santo state, southeastern Brazil, is described, illustrated, and compared to *D. oxyphylla* Turczaninow, a similar species that is found in Brazil, Colombia, and Venezuela.

A survey of the Asclepiadaceae of Espírito Santo, Brazil, turned up 44 species belonging to 16 genera. The largest genus is *Ditassa* with 11 species, including *D. oberdanii*. This species is found in remnant patches of lower montane rainforest in southeastern Brazil, in the Atlantic forest biome which is seriously threatened by human activities.

Ditassa oberdanii Fontella & Alvarez, sp. nov. TYPE: Brazil. Espírito Santo: Santa Teresa, Rio Saltinho, 500 m, 26 Apr. 1984, *Pizziolo* 22 (holotype, MBML; isotype, HB). Figure 1.

Species nova *D. oxyphyllae* Turczaninow affinis, sed imprimis foliis linear-lanceolatis angustioribus, corollae lobis extus glabris et longioribus, caudiculis non geniculatis, polliniis ellipticis vel subellipticis et latioribus differt.

Vines; stems hirsute-tomentose. Leaves with flattened petioles, hirsute above, glabrescent beneath, 7–10 mm long; blade linear-lanceolate, glabrous to glabrescent with secondary nerves rectilinear, base cuneate with two glands at petiole juncture, apex acuminate, 61–69 × 10–13 mm. Inflorescence an umbelliform cyme, extra-axillary, 3–6-flowered; peduncles hirsute-tomentose, 1–2 mm. Flowers white; pedicels hirsute, 2–4 mm long. Calyx deeply lobed; lobes ovate-lanceolate, hirsute outside, glabrous inside, margins hyaline, 2–2.5 × 1–1.5 mm, with 1–2 minute inside glands at base of each sinus; corolla subcampanulate; tube glabrous outside, pubescent inside, 0.8–1.0 mm long; lobes linear-lanceolate, glabrous outside, pubescent inside on upper half at margin, with longer hairs at apex, 4–5 × 1–1.3 mm. Corona lobes filiform, twice the length of the gynostegium, upper part papillose, the outer 3–3.2 × 0.1–0.3 mm, apex slightly curved, the inner 3.5–4 × 0.2–0.3 mm, apex curving inward. Anthers rectangular or subrectangular, ca. 0.75 × 0.57 mm, appendages membranaceous, suborbicular, ca. 0.42 mm long. Corpusculum ovate, 0.20–0.22 × 0.08–0.09 mm; translator arms filiform, 0.06–0.09 mm long; pollinia elliptic or subelliptic, longer than corpusculum, slightly curved, 0.24–0.28 × 0.09–0.17 mm. Stigmatic appendix apiculate.

This new species is related to *Ditassa oxyphylla* Turczaninow, from which it differs mainly by the linear-lanceolate leaves, longer corolla lobes (4–5 mm), which are glabrous outside, straighter translator arms, and wider (0.09–0.17 mm), elliptic to subelliptic pollinia. In contrast, *D. oxyphylla* has ovate-lanceolate to elliptic leaves, corolla lobes 2–3 mm long, geniculate translator arms, and oblong to subclavate pollinia (0.06–0.08 mm wide).

Ditassa oxyphylla is found in Colombia, Venezuela, and Brazil, where it occurs in Pernambuco, Alagoas, and Bahia states; in Bahia it is found in caatinga, remnant liana forest (Mata de Cipó) and pastures, from 500–600 m above sea level (Pereira & Silva, 1973; Pereira et al., 1989).

Ditassa oberdanii is named in honor of Oberdan José Pereira, Professor of Botany at the Espírito Santo Federal University (UFES), who has contributed greatly to the study of the flora of Espírito Santo, Brazil.

Acknowledgments. We thank the CNPq for Jorge Fontella-Pereira's research fellowship, the curators of R, RB, GUA, MBML, VIES, and CVRD, Dorothy Sue Dunn de Araujo for the translation of the text into English, and Gloria Gonçalves for the sketch.

Literature Cited

Pereira, J. F. & N. M. F. da Silva. 1973. Estudos em Asclepiadaceae III. Sôbre a identidade de *Nematuris volubilis*. Arch. Jard. Bot. Rio de Janeiro 19: 223–226

———, M. da C. Valente, R. Harley & N. M. F. da Silva. 1989. Contribuição ao estudo das Asclepiadaceae Brasileiras—XXIV. Checklist preliminar do Estado da Bahia. Rodriguésia 41(67): 81–115.

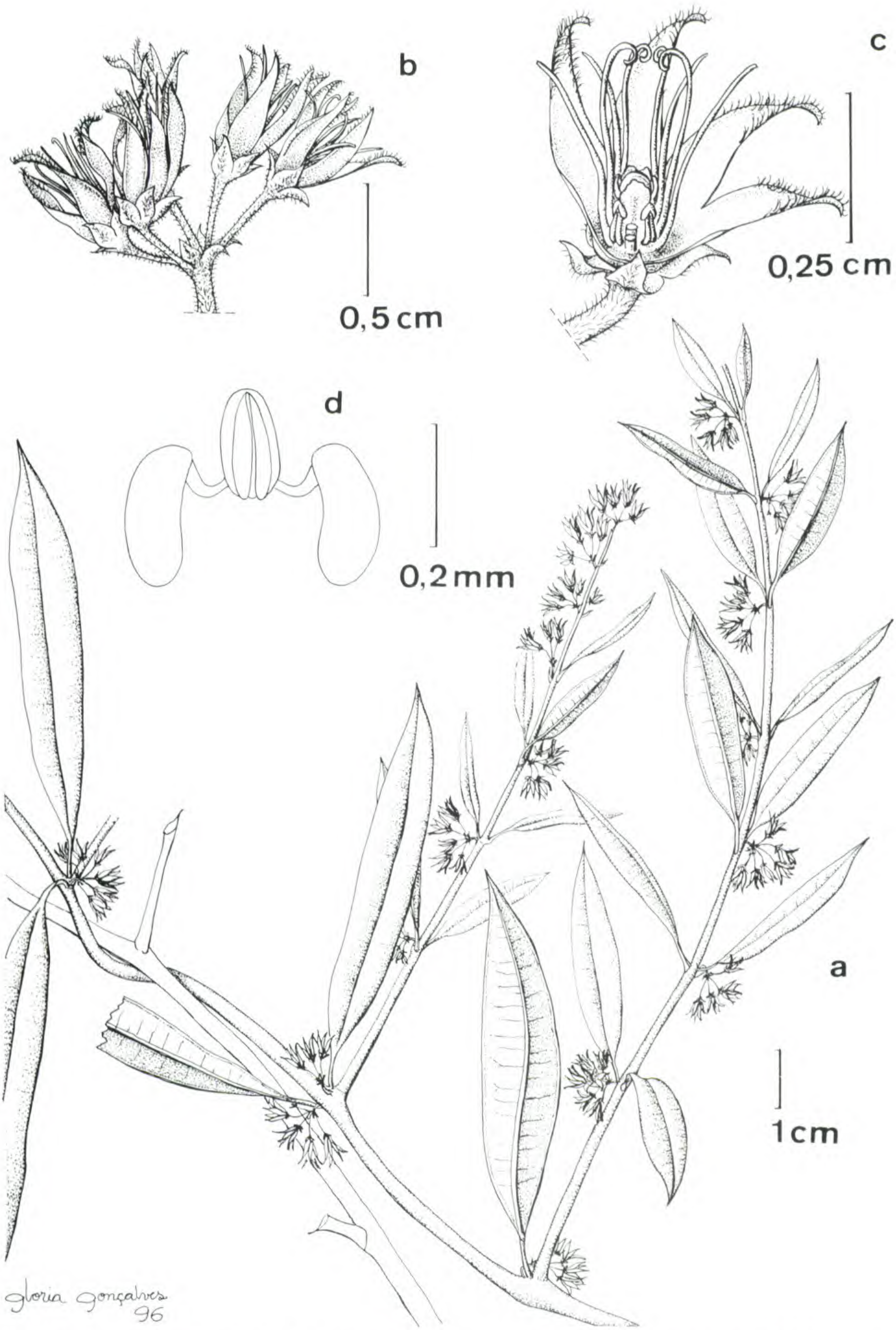


Figure 1. *Ditassa oberdanii* Fontella & Alvarez, drawn from the holotype, *Pizziolo 22*, MBML. —a. Habit. —b. Inflorescence. —c. Flower, one corolla lobe and one corona element removed. —d. Pollinarium.

Two New Combinations in *Stuckenia*, the Correct Name for *Coleogeton* (Potamogetonaceae)

Robert R. Haynes
Department of Biological Sciences, University of Alabama, Tuscaloosa, Alabama 35487-0344, U.S.A.

Donald H. Les
Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut 06269-3042, U.S.A.

M. Král
33901 Klatovy 296./III, Macharova ul. 10., Czech Republic

ABSTRACT. *Coleogeton* and *Stuckenia* are based on the same type species. *Stuckenia* has priority over *Coleogeton*, making *Coleogeton* superfluous. All necessary new combinations for taxa that occur in North America are proposed for use in the *Flora of North America*. These combinations include *S. filiformis* subsp. *alpina* and *S. filiformis* subsp. *occidentalis*.

Les and Haynes (1996) elevated *Potamogeton* L. subg. *Coleogeton* Reichenbach to generic status, assigning the name *Coleogeton* (Reichenbach) Les & Haynes to it. They chose *C. pectinatus* (L.) Les & Haynes (basionym: *P. pectinatus* L.) as the type species and made all combinations that were necessary for use in *Flora of North America*. Shortly after the article appeared, one of us (Král), in a letter addressed to Les, pointed out that Börner (1912a) had elevated the subgenus to the generic level and had given it the generic name *Stuckenia* Börner. After examining the protologue of *Stuckenia*, Les and Haynes determined that to be correct. Similarly, Börner (1912a) selected *P. pectinatus* as the type species. Consequently, the generic name *Coleogeton* is superfluous. Börner did not make the combination *S. pectinata* at that time, but did formally make it later that year (Börner, 1912b). Holub (1984, 1997) subsequently made all relevant combinations at the species level. He did not, however, make any combinations at the infraspecific levels.

This publication makes the necessary infraspecific combinations of *Stuckenia* for use in *Flora of North America*. See Les and Haynes (1996) for relevant discussions, typification, and synonymy. The sequence of names mirrors that in Les and Haynes (1996).

1. **Stuckenia striata** (H. Ruíz & J. Pavón) J. Holub, Preslia 69: 364. 1997.
2. **Stuckenia pectinata** (L.) C. Börner, Fl. Deutsche Volk 713. 1912.
3. **Stuckenia filiformis** (C. H. Persoon) C. Börner, Fl. Deutsche Volk 713. 1992.

3a. **Stuckenia filiformis** (C. H. Persoon) C. Börner subsp. **alpina** (Blytt) R. R. Haynes, D. H. Les & M. Král, comb. nov. Basionym: *Potamogeton marinus* f. *alpinus* Blytt, Norges Flora 1: 370. 1861.

3b. **Stuckenia filiformis** (C. H. Persoon) C. Börner subsp. **occidentalis** (J. W. Robbins) R. R. Haynes, D. H. Les & M. Král, comb. nov. Basionym: *Potamogeton marinus* L. var. (?) *occidentalis* J. W. Robbins, in S. Watson, Bot. King's Explor. 339. 1871.

4. **Stuckenia vaginata** (N. Turczaninow) J. Holub, Folia Geobotanica et Phytotaxonomica, Praha 19: 215. 1984.

Acknowledgments. We thank W. D. Stevens, of the Missouri Botanical Garden, for helping us obtain the original literature of *Stuckenia*.

Literature Cited

Börner, C. 1912a. Botanisch-systematische Notizen. Abh. Naturwiss. Vereine Bremen 21: 245–282.
———. 1912b. Eine Flora für Deutsche Volk. Leipzig.
Holub, J. 1984. Some new nomenclatural combinations. I. Folia Geobot. Phytotax. 19: 213–215.
———. 1997. *Stuckenia* Börner 1912—The correct name for *Coleogeton* (Potamogetonaceae). Preslia 69: 361–366.
Les, D. H. & R. R. Haynes. 1996. *Coleogeton* (Potamogetonaceae), a new genus of pondweeds. Novon 6: 389–391.

A New *Hymenocallis* (Amaryllidaceae) from Sonora, Mexico

Joseph E. Laferrière
Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, U.S.A.

ABSTRACT. *Hymenocallis clivorum* is a new member of the Amaryllidaceae from southern Sonora, Mexico. It is unusual in the genus in that it occurs on steep slopes in a semi-arid environment.

RESUMEN. *Hymenocallis clivorum* es una nueva especie de las Amaryllidáceas del sur de Sonora, México. Es excepcional en el género en que se halla sobre las inclinaciones empinadas en ambiente semiárido.

A collection was made recently of the genus *Hymenocallis* that differs morphologically and ecologically from previous collections. It is extremely unusual in the genus because it grows on steep slopes in a semi-arid environment. Most of the other species grow in or near standing or running water, and many of them have water-dispersed seeds (Bauml, 1979; Flory 1976, 1978; Godfrey & Wooten, 1979; Howard, 1978). The relatively xerophytic Sonoran plant is described below as a new species.

Hymenocallis clivorum Laferrière, sp. nov. TYPE: Mexico. Sonora: Agua Amarilla (Los Pinitos), 15 km WNW of Tepoca on Mexico 16 (Km 200 E of Hermosillo), 28°28′01″N, 109°20′23″W, 900 m, 13 July 1997, *A. L. Reina G. 97-591, T. R. Van Devender, D. Larson, P. Merlin, M. J. Martinez* (holotype, ARIZ; isotype, MEXU).

A *H. pimana* foliis latioribus, poculo staminali breviore, et floribus multioribus differt; a *H. sonorensi* foliis angustioribus differt.

Bulb ovoid, 4.5–6 cm long, 30–37 mm diam., dark brown, with a subterranean neck 4–5 cm long. Leaves narrow, ensiform, spreading, very glaucous, 9–16 mm wide, 25–35 cm long. Scape solitary, compressed, glaucous, 20–45 cm tall, 3 mm wide at base, gradually tapering to 10 mm wide at apex. Inflorescence capitate; outer floral bracts subulate, scarious, hyaline, 60–70 mm long. Flowers 8–11, sessile, erect; perigone tube green, 8–10 cm long, uniformly 1 mm diam. throughout its length; tepals white, persistent, spreading, 1.0–1.5 mm wide, 40–60 mm long including staminal cup; staminal cup broadly funnelform, white, 18–21 mm long, 10–15 mm diam., the margin entire; filaments green, white at base; anthers pale yellow, exserted, versatile, 14–17 cm long; locules 3; ovules 1–5 per locule; style exserted, green, 14–17 cm long; stigma green, capitate, 3-lobed. Seeds ellipsoid, 8–10 mm long, 4–5 mm wide.

Hymenocallis clivorum differs morphologically from *H. pimana* Laferrière in having slightly wider leaves (9–16 mm vs. 5–11 mm), a shorter staminal cup (18–21 mm vs. 25–50 mm), and more numerous flowers (8–11 vs. (1–)2–6(–8)). The leaves, though wider than *H. pimana*, are still much narrower and more intensely glaucous than those of *H. sonorensis* Standley (Laferrière, 1990, and see key, below). *Hymenocallis sonorensis* also has narrower staminal cups (see key). These are currently the only three species described from Sonora. Other populations of the genus not referable to any of these species have been reported elsewhere in the state (Fishbein, pers. comm.; Van Devender, pers. comm.), but at present insufficient material has been collected to allow formal descriptions. A key to the currently recognized Sonoran species is as follows:

1a. Staminal cup 18–21 mm high.
  2a. Leaves very glaucous, 9–16 mm wide; staminal cup 10–15 mm diam . . . . *Hymenocallis clivorum*
  2b. Leaves slightly glaucous, 15–30 mm wide; staminal cup 15–26 mm diam . . *Hymenocallis sonorensis*
1b. Staminal cup 25–50 mm high . . . . . *Hymenocallis pimana*

Ecologically, *Hymenocallis clivorum* differs strikingly from both *H. pimana* and *H. sonorensis*. *Hymenocallis sonorensis* occurs mostly along streambanks and roadsides at low elevations, whereas *H. pimana* grows in open, grassy, anthropogenic clearings in pine-oak forest over 1500 m in the Sierra Madre Occidental (Laferrière, 1990, 1994). *Hymenocallis clivorum* occurs on dry, rocky slopes in tropical deciduous forest, at an elevation of less than 1000 m. "Clivorum" is the genitive plural of the Latin word "clivus," i.e., "slope."

Paratype. MEXICO. **Sonora**: Alamos Study Area, 7.5

mi. [12 km] NW of Alamos, [ca. 400 m fide Fishbein], 20 July 1968, *R. Krizman s.n.* (ARIZ).

Acknowledgments. I thank Mark Fishbein, James A. Bauml, Thadeus M. Howard, Philip Jenkins, Jessica Piper, Thomas Van Devender, and David Yetman for kind advice and assistance.

Literature Cited

Bauml, J. A. 1979. A study of the genus *Hymenocallis* (Amaryllidaceae) in Mexico. M.S. Thesis, Cornell University, Ithaca.

Flory, W. S. 1976. Distribution, chromosome numbers, and types of various species and taxa of *Hymenocallis*. Nucleus 19: 20–227.

———. 1978. Known distribution of *Hymenocallis* Salisbury in North and Middle America and the West Indies. Pl. Life 34: 47–59.

Godfrey, R. K. & J. W. Wooten. 1979. Aquatic and wetland plants of the southeastern United States: Monocotyledons. Univ. Georgia Press, Athens.

Howard, T. M. 1978. Current status of some endangered Mexican *Hymenocallis* species. Pl. Life 7: 157–158.

Laferrière, J. E. 1990. *Hymenocallis pimana* (Amaryllidaceae): A new species from northwestern Mexico. Phytologia 68: 255–259.

———. 1994. Vegetation and flora of the Mountain Pima village of Nabogame, Chihuahua, Mexico. Phytologia 77: 102–140.

A New Species of *Calycolpus* (Myrtaceae) from the Campos Rupestres, Minas Gerais, Brazil

Leslie R. Landrum
Department of Botany, Arizona State University, Tempe, Arizona 85287-1601, U.S.A.

ABSTRACT. *Calycolpus australis* (Myrtaceae) of Minas Gerais, Brazil, is described as a new species. It is perhaps most similar to *C. alternifolius* but differs in various floral characters. This new species extends the range of the genus six degrees of latitude farther south.

Calycolpus is a genus of ca. 10 species ranging from Central America to Brazil with the greatest diversity in northeastern South America, especially in the Guyana Highlands (McVaugh, 1969). It is closely related to *Psidium*, but can be distinguished from that and other related genera by floral and seed coat characters (Landrum & Sharp, 1989). Recently a new species has come to my attention from the "campos rupestres" of Minas Gerais of Brazil that extends the southern range of *Calycolpus* nearly six degrees of latitude farther south.

Calycolpus australis Landrum, sp. nov. TYPE: Brazil. Minas Gerais: Itambé do Mato Dentro, estrada para Serra Cabeça de Boi, 5 km de Itambé, 13 Jan. 1982 (fl), *N. Hensold, M. T. Rodrigues, N. L. Menezes & M. L. Kawasaki CFCR 2836* (holotype, SPF 22316; isotypes, ASU, UB). Figure 1.

C. alternifolio (Gleason) Landrum primo adspectu simillima, sed flores multi grandiores.

Frutex circa 2-metralis; pili albi vel luteoli, simplices; ramuli juventute breviter tomentosi; folia 1.7–5.3 cm longa, 1.1–2.5 cm lata, 1.2–3-plo longiora quam latiora; apex acutus vel acuminatus vel rotundatus nonnunquam cuspidatus; basis rotundata vel acuta; laminae coriaceae, in sicco atrovirideo-olivaceae vel atrorufo-brunneae; hypanthium campanulatum, 5–6 mm longum, dense puberulum; stylus circa 11 mm longus, glaber; stamina 250–300, circa 10 mm longa, antheris circa 1.3 mm longis, connectivum 7–14-glandulis; ovarium 3–4-loculare, loculis 9–14-ovulatis.

Shrub to ca. 2 m high, the young growth and lower leaf surface densely short-tomentose; hairs simple, whitish or yellowish, up to ca. 1 mm long, often curly; young twigs shortly tomentose, sometimes losing most hairs, then reddish brown, sometimes obscurely 4-winged, the bark of older twigs becoming rough, gray; leaves elliptic, ovate, lanceolate, or obovate, 1.7–5.3 cm long, 1.1–2.5 cm wide, 1.2–3 times as long as wide; apex acute or acuminate to rounded, sometimes cuspidate; base rounded to acute; petiole weakly channeled or flat, 1–2 mm long, 1–1.5 mm thick, tomentose to glabrous; midvein impressed above, prominent below; lateral and marginal veins indistinct; blades coriaceous, drying dark olive-green to reddish brown, with many minute glands visible above; peduncles 1.5–3 cm long, 1.5–2 mm wide at apex, solitary, thinly pubescent; bracteoles apparently caducous early, only one seen, perhaps not typical, ca. 6 mm long, ca. 1 mm wide; calyx lobes two-parted, the base an extension of the hypanthium, ca. 3 mm long, ca. 5–6 mm wide, rectangular, puberulent within and without, slightly concave within, fused along the margins with the adjacent bases for about ½ of length, the distal portion of calyx lobe (appendage) leafy, oblong-triangular, glabrous, 6–11 mm long, ca. 4–6 mm wide, erect or reflexed, sparsely to densely pubescent beneath, subglabrous to pubescent above; petals obovate, concave, ca. 1.5 cm long, ca. 1.2 cm wide; hypanthium campanulate, 5–6 mm long, densely pubescent, tearing ca. 1 mm between calyx lobe bases at anthesis; disk ca. 7 mm across, the staminal ring puberulent, ca. 3 mm wide; stamens 250–300, ca. 10 mm long; anthers 1.3 mm long, with 7–14 glands in connective; style 11 mm long; ovary 3–4-locular; ovules 9–14 per locule, the placenta an oblong pad, sometimes slightly raised; fruit subglobose, about 1 cm diam., dark purple beneath hairs; seeds apparently few, ca. 2.5–3 mm long, the seed coat lustrous, ca. 1 cell thick across distal wall, the cells nearly isodiametric.

Calycolpus australis is most similar to *C. alternifolius*. The differences are summarized in the key below.

1a. Closed flower bud ca. 7 mm long; disk 2–4 mm across; calyx lobes triangular, not two-parted, 3–5 mm long; petals 8–9 mm long; stamens 38–70, 3–5 mm long; style ca. 5 mm . . . . *C. alternifolius*
1b. Closed flower bud ca. 15 mm long; disk ca. 7 mm across; calyx lobes two-parted (see description), the distal leafy portion 6–11 mm long; petals ca. 15 mm long; stamens 250–300, ca. 10 mm long; style ca. 11 mm long . . . . . *C. australis*

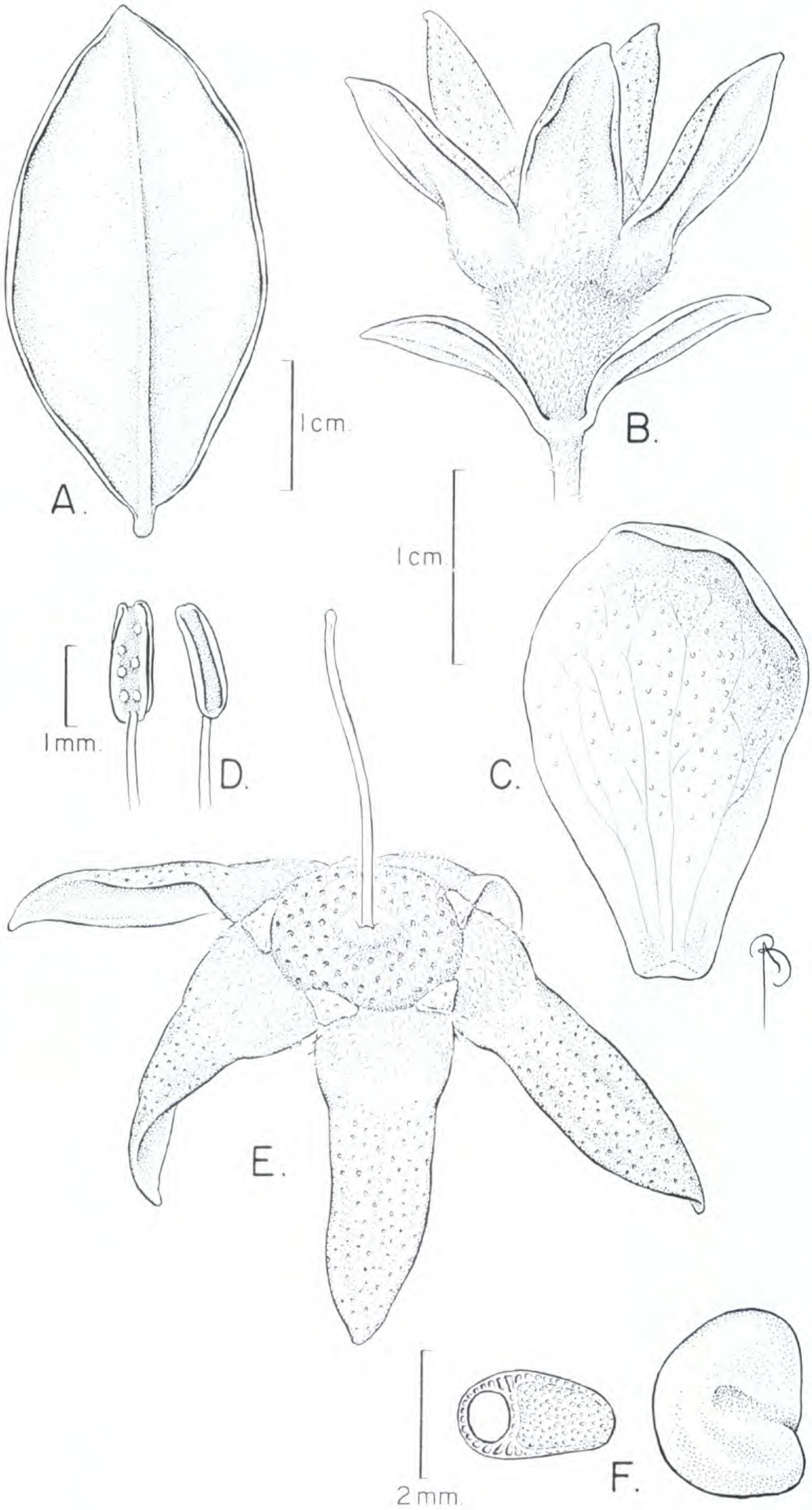


Figure 1. *Calycolpus australis* Landrum. —A. Leaf from below. —B. Flower bud showing calyx lobes with clasping concave base and leafy distal portion (appendage). —C. Petal showing inner surface. —D. Two anthers, one showing glands in the connective. —E. Flower after anthesis showing calyx lobes with pubescent base and glabrous appendage. —F. Seed in section and a side view. A–E drawn from *Hensold et al. CFCR 2836* (SPF 22316); F drawn from *Kawasaki et al. 870.*

Calycolpus australis forms a morphological link between *C. alternifolius*, a somewhat unusual species in the genus, and the more typical species, *C. goetheanus* (DC.) O. Berg, for instance. Its closest geographic relative is *C. legrandii* Mattos of Bahia and Sergipe. *Calycolpus australis* grows in very rocky soil that appears to be quite sterile. The general vegetation is a sparse growth of shrubs. *Calycolpus legrandii* grows in sandy "restinga" habitats, and *C. alternifolius* on rocky tepui summits. Perhaps species of *Calycolpus* are best able to compete on nutrient-poor substrates. *Calycolpus australis* is known from a single locality and thus may be quite restricted in distribution.

Paratypes. BRAZIL. **Minas Gerais:** Itambé do Mato Dentro, estrada para a Serra da Cabeça de Boi, ca. 500–800 m após o Canta Galo, campo rupestre, 9 Aug. 1992 (fl), *J. R. Stehmann & M. Sobral 1111* (ASU); Itambé do Mato Dentro, 5 km de Itambé, estrada para Serra Cabeça de Boi, depois da praia Canta Galo, 12 Oct. 1995 (fl), *M. L. Kawasaki, L. R. Landrum & S. S. Landrum 870* (fr), *869, 871, 872, & 873* (young fr) (all ASU, SP).

Acknowledgments. I am grateful to M. Sobral for bringing this new species to my attention. I thank M. L. Kawasaki for helping to locate and collect specimens in the field and for a careful review of this manuscript. Fieldwork in Brazil was made possible by a Fulbright American Republics grant. Figure 1 was drawn by Bobbi Angell.

Literature Cited

Landrum, L. R. & W. P. Sharp. 1989. Seed coat characters of some American Myrtinae (Myrtaceae): *Psidium* and related genera. Syst. Bot. 14: 370–376.

McVaugh, R. 1969. Myrtaceae. *In*: The botany of the Guayana Highland—Pt. 8. Mem. New York Bot. Gard. 18(2): 55–286.

New Species and Combinations in Mesoamerican *Randia* (Rubiaceae: Gardenieae)

David H. Lorence
National Tropical Botanical Garden, P.O. Box 340, Lawai, Hawaii 96765, U.S.A.
Email: lorence@ntbg.org

ABSTRACT. *Randia nicaraguensis* Lorence & Dwyer from Nicaragua is described and illustrated. Two new combinations are proposed for Mesoamerican Gardenieae: *Randia genipifolia* (Standley & Steyermark) Lorence, based on *Duroia genipifolia* Standley & Steyermark, and *Randia armata* (Swartz) DC. subsp. *panamensis* (Standley) Lorence, based on *Randia panamensis* Standley.

Randia L. (Gardenieae) is a genus of over 90 species distributed in the New World tropics and subtropics, ranging from northern Mexico and Texas through Mexico, Central America, and the Caribbean into South America (Lorence & Dwyer, 1987). During the course of preparing the Rubiaceae treatment for *Flora Mesoamericana*, collections representing an undescribed species from Nicaragua were encountered. In addition, two new combinations are proposed in Mesoamerican *Randia*.

Randia nicaraguensis Lorence & Dwyer, sp. nov. TYPE: Nicaragua. Estelí: 4.9–7.6 km NE of Hwy. 1 at Estelí along road to Yalí, ca. 13°08–09′N, 86°19–20′W, 1100 m, 14 Nov. 1979, *W. D. Stevens & A. Grijalva 15553* (holotype, MO-2872306; isotypes, F, HNMN, MEXU, MO). Figure 1.

Species *Randiae monanthae* Bentham affinis, sed foliis supra glabris, subtus secus costam et venas sparsius strigillosis, hypanthio et calyce strigilloso vel glabrato, calycis lobis subulatis 0.5–1 mm longis, tubo corollino 15–18 mm longo extus glabro, corollae lobis 10–16 × 6–7 mm glabris differt.

Dioecious, deciduous small tree or shrub 2–8(–12) m tall, the trunk 12–25 cm diam., spiny, the bark gray, exfoliating, the crown narrow, the twigs terete, 2–4.5 mm diam., usually armed with 1–2 (less commonly 3–4) stout spines at or near apex, the spines (3–)4–12 mm long, slightly recurved, the lateral twigs (short shoots) usually decussate, 2–10 cm long, 2–5 mm diam., glabrous, sparsely lenticellate, the bark thin, brown, peeling. Leaves clustered beyond spines on swollen, unbranched twig tips, shortly petiolate or subsessile; petioles 4–15 × 1–1.2 mm, strigillose, winged from the decurrent lamina, adaxially sulcate; lamina obovate, obovate-elliptic, or elliptic, 4–10 × 2–5 cm, chartaceous or subcoriaceous, drying dark greenish brown, adaxially glabrous, abaxially strigillose on costa and 2° and 3° veins, the base attenuate and decurrent, the apex obtuse or rounded, the 2° veins 6–7(–8) pairs, the venation adaxially impressed and visible to 4°, abaxially prominulous and visible to 5°; stipules on short shoots persistent, broadly deltoid or ovate-deltoid, 2–6 × 2–4 mm, brown, externally glabrous or sparsely strigillose, often white punctate, the margins scarious, internally densely villous-sericeous with white hairs, colleters absent, stipules on long shoots similar but broadly deltoid, 2–3 × 2 mm, tardily deciduous. Flowers of both sexes terminal, solitary or paired, 4–5-merous, subtended by stipule-like bracts. Staminate flowers with strigillose pedicels 2–4 mm long, 1.5 mm diam., hypanthium broadly obconical, 2–3 mm long and wide, strigillose or glabrate, calyx cup 1–2 mm deep, externally strigillose or glabrate, internally strigillose, margin with 5 sparsely strigillose subulate teeth 0.5–1 mm long; corolla with white or yellow lobes and green tube when fresh, fragrant, salverform, the tube 15–18 × 3–4 mm medially, externally glabrous, internally sparsely villous in upper half, the lobes ovate, 10–16 × 6–7 mm basally, apically acute to obtuse, both sides glabrous; stamens attached in upper ¼ of tube, the anthers linear, 5–6 mm long; style 16 mm long, glabrous, the stigma slightly bilobed, slightly exserted. Pistillate flowers with hypanthium obconical-ellipsoid or cylindrical-ellipsoid, 10–14 × 5–6 mm, strigillose or glabrate, the calyx cup 3–5 mm deep, glabrate on both sides, often splitting along one side, the margin with 5 sparsely puberulent subulate teeth 0.5–1 mm long; corolla salverform, the tube 10–15 × 3–4 mm medially, externally glabrous, internally villous distally, the lobes broadly ovate, 8–15 × 6–8 mm, apically acute to obtuse, both sides glabrous; anthers attached near middle of tube, linear, 3.5 mm long; style 15 mm long, glabrous, the stigma lobes 4 mm

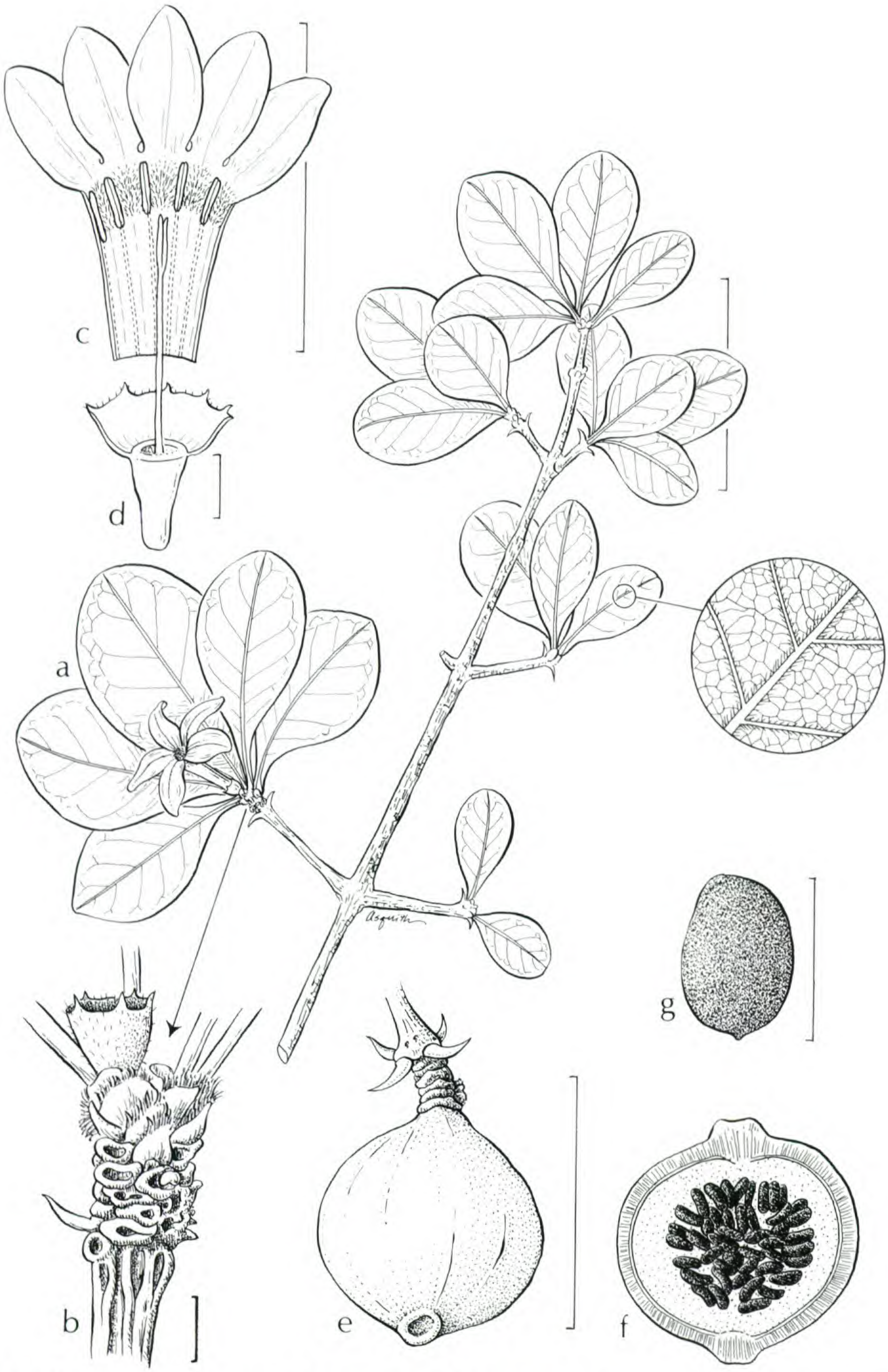


Figure 1. *Randia nicaraguensis* Lorence & Dwyer. —a. Habit, staminate plant. —b. Detail of twig apex. —c. Staminate corolla, opened. —d. Pistil of staminate flower. —e. Fruit. —f. Fruit, longitudinal section. —g. Seed. a–d, *Moreno 21531;* e–g, *Moreno 18530.* Bars = 5 cm in a, e, f; 4 mm in b, d; 37 mm in c; 8 mm in g.

long. Fruits hard, spheroidal or obovoidal-spheroidal, (35–)45–70 mm diam., brownish or grayish, smooth, glabrate, apex umbonate, the calyx lobes not persistent, the wall 3–5 mm thick, the pedicel thickened, 5–10 × 10–12 mm; seeds tan, irregularly discoidal or triangular-discoidal, 7–9 mm diam., imbedded in dark brown pulp.

Distribution. Known only from Nicaragua in the Departments of Boaco, Carazo, Chontales, Estelí, León, Managua, Matagalpa, Nueva Segovia, and Rivas.

Habitat and phenology. This new species occurs from near sea level to 850 m elevation in tropical deciduous forest (bosque seco tropical), savannas with *Crescentia alata,* gallery forest along rivers (bosque de galería), less commonly in tropical semideciduous forest (selva mediana perennifolia) or mangrove vegetation, and rarely in tropical montane mesic forest (bosque mesófilo) up to 1850 m elevation. Flowering specimens have been collected from May to July and fruiting specimens from June to April. In Nicaragua *Randia nicaraguensis* is known by the following vernacular names: "comida de ardilla," "cruceto," and "jicarillo."

Among its Mexican and Central American congeners, *Randia nicaraguensis* is closely allied to *R. monantha* Bentham, which ranges from southern Mexico and Guatemala along the Pacific slope to Costa Rica. The latter species differs by its densely strigillose-hirtellous leaves, strigillose hypanthium and calyx with longer, linear-subulate or foliaceous calyx lobes 2–7 mm long, and larger, externally hirtellous or strigillose corolla with a tube 50–65 mm long and lobes 25–28 × 5–6 mm.

Paratypes. NICARAGUA. **Boaco**: Camino Boaquito–Santa Lucía, hacienda Penas Blancas, 4 km al E de Boaco, 400–600 m, 26 Dec. 1984, *Grijalva & Soza 4195* (MO); El Ojo de Agua, carretera a Santa Lucía, 1 km al E de El Papaturro, 180–200 m, 30 July 1981, *Moreno 10108* (MO); 2 km al N de Boaquito, camino a Santa Lucía, carretera 47, 12°28′N, 85°44′W, 200–300 m, 20 July 1981, *Moreno 10116* (MO); 2 km al N de Boaquito, 12°28′N, 86°44′W, 260–280 m, 2 June 1983, *Moreno 21546* (MO), 2 km al N de Boaquito, 12°28′N, 85°44′W, 300 m, 9 Oct. 1981, *Moreno 11892B* (MO); 4 km al S de Boaquito, San Antonio, 12°26′N, 85°44′W, 200 m, 21 Oct. 1982, *Moreno 18073* (MO); Hacienda San Antonio, carretera a Boaquito, 12°26′N, 85°44′W, 200 m, 14 July 1983, *Moreno 21531* (MO), 17 Jan. 1984, *Moreno & Robleto 22817* (MO); 6 km NE de Boaco, 12°29′N, 85°42′W, 500 m, 10 July 1983 (fr), *Grijalva & Sandino 2767* (MO); sobre el Río Boaco o Fonseca, 3 km al SE de Boaquito, 12°26′N, 85°43′W, 200 m, 7 Nov. 1983, *Moreno 22491* (MO); San Lorenzo, 2 km al E, Sierra Espino, 12°23′N, 85°39′W, 500–600 m, 11 Nov. 1982, *Moreno 18530* (MO); 3 km N of Tecolostote, along Río San Lorenzo, 12°16′N, 85°39′W, 120 m, 7 June 1984, *Stevens 22924* (MO), *22929* (MO). **Carazo**: Filetes El Gallo, 7 km SE de La Trinidad, 100–200 m, 13 June 1983, *Grijalva 2651* (MO); Río Paso Carreta, NW de Boquita, 11°42′N, 86°23′W, 13 July 1982, *Sandino 3237* (MO); La Palma, Chacocente, 12 Dec. 1984, *Aranda 128* (MO). **León**: El Guayabal, 100 m, 9 May 1984, *Castro 127* (MO); Laguna de Asososca, ca. 6 km al NW de Puerto Momotombo, 12°26′30″N, 86°40′W, 200 m, 14 July 1984, *Grijalva et al. 3872* (MO); along Hwy. 12 ca. 1 km SE junction with Hwy. 28 (1st quebrada SE of junction), 30 m, 6 Oct. 1979, *Stevens 14657* (MO); W of Quebrada Las Ruedas, NW of El Transito, 12°05′N, 86°43′W, 15–30 m, 10 Dec. 1977, *Stevens 5452* (MO); along Hwy. 1 ca. 1 km SE of Hwy. 28, 12°15′N, 86°43′W, 30 m, 17 Dec. 1978, *Stevens 11181* (MO); Estero Brasil, ca. 2 km S of Hwy. 32 on road to Velero, 12°10′N, 86°45′W, < 10 m, 28 May 1980, *Stevens et al. 17275* (MO); de Larreynaga 5 km al NW del Cerro Pelón, 12°32′43″N, 86°35′24″W, 100 m, 2 Nov. 1993, *Vega & Quezada 146* (MO). **Managua**: Las Maderas, Comarca La Reforma, ca. 2 km NE del poblado Las Maderas, 200 m, 31 Oct. 1984, *Grijalva & Aranda 4095* (MO); 4.5 km NNW of Highway 12 on ridge of Sierra de Mateare, 12°07′N, 86°23′W, 430 m, 8 July 1978, *Stevens 9244* (MO 2 sheets); Río Pacora, ca. 10 km SE de San Francisco Libre, 12°31′N, 86°14′W, ca. 60 m, 11 Mar. 1983, *Grijalva 2389* (MO); sobre el camino hacia San Francisco del Carnicero, 2 June 1983, *Rocha 8* (MO). **Chontales**: 5 km SE de Camoapa, Tolinapa, 300–400 m, 15 Nov. 1982, *Moreno 18641* (MO). **Estelí**: 7 km from Hwy. 1 (km 193) on rd. to Pueblo Nuevo from Quebrada Jamailí to near summit of Cerro El Pedrero, 13°21′N, 86°27′W, 600–700 m, 3 July 1977, *Stevens 2612* (MO); "Cucamonga," Carretera Panamericana Km 160–161, 800–850 m, 7 Mar. 1982, *Moreno 15913* (MO); en la Laguna de Miraflores, camino a Estelí–Miraflores, 1850 m, 29 Aug. 1982, *Martinez S. & Grijalva 1912* (MEXU, MO); Estelí, Carretera N, 815–850 m, 29 Sep. 1983, *A. Laguna 302* (MO); Cuesta de Cucamonga, 13°15′N, 86°22′W, 830 m, 17 Apr. 1981, *Moreno 8352* (MO); Km 167 on Hwy. 1, 15.8 km N of entrance to Estelí, 13°15′N, 86°22′W, 825–850 m, 30 Dec. 1977, *Stevens 5776* (MO); Isiquí, 14 June 1984, *Laguna 397* (MO). **Matagalpa**: camino viejo a Jinotega, ca. 5 km al NW de la ciudad de Matagalpa, Río Waswalí, 22 July 1983, *Grijalva & Ortiz 2810* (MO). **Nueva Segovia**: camino entre Ococona y Llanos de Santa María, 13°44′N, 86°40–41′W, 15 May 1982, *Sandino 2961* (MO). **Rivas**: at convegence of Río La Pita and Río Escalante, at border of Depts. of Carazo and Granada, 20 m, 3 Aug. 1978, *Stevens 9690* (MO).

Randia genipifolia (Standley & Steyermark) Lorence, comb. nov. Basionym: *Duroia genipifolia* Standley & Steyermark, Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 186. 1940. TYPE: Guatemala. Izabal: Río Dulce, between Livingston and 6 mi. up river, on N side (right side going up river), sea level, 14 Apr. 1940, *J. A. Steyermark 39382* (holotype, F 1035218, photo PTBG).

Randia gentlei Lundell, Wrightia 4: 125. 1969. Syn. nov. TYPE: British Honduras (Belize). Toledo Distr.: Edwards Rd. beyond Columbia, 24 May 1951, *P. H. Gentle 7343* (holotype, TEX-LL, photos MEXU, PTBG; isotypes, F, S (2 sheets not seen), TEX-LL (2 sheets), US (photos MEXU, PTBG)).

Duroia L.f., also a member of the Gardenieae, ranges from southern Central America to South America and comprises over 30 species (Andersson, 1992; Dwyer, 1980). As in the related genus *Randia*, species of *Duroia* are also dioecious shrubs or small trees with large, baccate fruits containing numerous seeds. *Duroia* differs from *Randia* in having calyptrate, circumscissile, and deciduous stipules, 5–9(–12)-merous flowers, a 1–4-locular ovary with 5–6 parietal placentas sometimes joined in the center, and triporate monad pollen grains.

Examination of the type of *Duroia genipifolia* and additional collections from Guatemala and Belize shows this species is clearly referable to the genus *Randia* based on its 5-merous flowers, unilocular ovary with two large, bilobed parietal placentas, and pollen grains united in permanent tetrads. Examination of the type of *Randia gentlei* reveals it to be conspecific with *R. genipifolia* and thus synonymous. This species is currently known from only a few collections collected in the Caribbean lowlands of Belize and Guatemala.

The Subspecies of *Randia armata* in Mesoamerica

Taylor and Lorence (1993) discussed the status and typification of *Randia armata* (Swartz) DC., a widespread and morphologically variable spiny shrub or small tree characteristic of moist and dry forests from Mexico and the Lesser Antilles to South America (Paraguay). *Randia panamensis* Standley, based on a specimen from Bocas del Toro, Panama, shares a number of morphological characters with *R. armata*. Indeed, the two species were combined in Dwyer's Rubiaceae treatment for *Flora of Panama* (Dwyer, 1980: 444).

Examination of numerous collections of *R. armata* and *R. panamensis* for a treatment of *Randia* for the *Flora Mesoamericana* project suggests that these two entities are better treated as subspecies: subsp. *armata*, which ranges from central western Mexico to the Lesser Antilles and South America; and subsp. *panamensis*, which is restricted to Panama. These two subspecies are modally distinct and in most cases are separable by the characters given in the key below. However, these features occasionally intergrade in certain collections. For example, both *Croat 5749* and *9131* from Barro Colorado Island, Panama, have stipules and calyx lobes that are intermediate between the two subspecies, but the armed twigs and longer pedicels are characteristic of subspecies *armata*. The collection *Sytsma 1714* from Río Guanche in Colón, Panama, has spheroidal fruits and calyx lobes characteristic of subspecies *panamensis*, but its stipules and distinct pedicels are characteristic of subspecies *armata*. Whether these deviating collections are the result of introgressive hybridization remains to be determined by field studies.

Randia armata (Swartz) DC. subsp. **panamensis** (Standley) Lorence, comb. et stat. nov. Basionym: *Randia panamensis* Standley, Publ. Field Columbian Mus., Bot. Ser. 4: 288. 1929. TYPE: Panama. Bocas del Toro: region of Almirante, Flat Rock, Jan.–Mar. 1928, *G. Proctor-Cooper 213* (holotype, F 579675, photos MEXU, PTBG).

Distribution and habitat. Subspecies *panamensis* is known only from Panama in the provinces of Coclé, Colón, Darién, Panamá, and San Blas. It occurs from 0 to 700 m elevation in lowland tropical moist and wet forest, riparian forest, and premontane wet forest, rarely in cloud forest from 1250 to 1450 m.

Additional collections studied. PANAMA. **Chiriquí:** Burica Peninsula, Rabo de Puerco, 8 km W of Puerto Armuelles, 50–150 m, 18 Feb. 1973, *Croat 21943* (MO). **Coclé:** Alto Calvario, Rivera sawmill, 600–800 m, 12 May 1977, *Folsom 3176* (MO); 12 mi. from Llano Grande, 700 m, 8°47′N, 80°28′W, 11 Dec. 1983, *Churchill et al. 4050* (MO); Caribbean side of [Continental] Divide at El Copé, 8°45′N, 80°35′W, 200–400 m, 3 Feb. 1983, *Hamilton & Davidse 2621* (MO, PTBG). **Colón:** Santa Rita Ridge trail beyond Santa Rita Ridge Rd. (Hwy. R20D), 400–800 m, 22 May 1975, *Mori & Crosby 6345* (MO); E of Santa Rita Ridge, 11 Jan. 1968, *Correa A. 593* (MO); trail from end Santa Rita Ridge Rd. to Río Piedras, 600 m, 16 Feb. 1980, *Antonio 3738* (MO); Santa Rita Ridge, 20 km from Transisthmic Hwy., Río Gatun drainage, 400 m, 9°25′N, 79°37′W, 22 Oct. 1981, *Knapp & Schmalzel 1766* (MO); Río Guanche, 9°30′N, 79°39′W, 0–75 m, 16 Oct. 1980, *Sytsma 1714* (MO); Río Guanche, 2.5 km upriver from bridge on rd. to Portobelo, 3 June 1975, *Mori et al. 6440* (MO). **Comarca de San Blas:** road from El Llano to Cartí, Pacific side, 79°00′W, 9°20′N, 350 m, 13 Feb. 1983, *Hamilton & Stockwell 2885* (MO); San Blas, trail from El Llano to Cartí–Tupile, Continental Divide, 400–200 m, 22 Feb. 1973, *Kennedy 2586* (MO); El Llano–Cartí Road, km 19.1, 9°19′N, 78°56′W, 9 Nov. 1984, *de Nevers & Herrera 4248* (MO, PTBG), 350 m, 18 Nov. 1984, *de Nevers 4308* (MO, PTBG); Cerro Habu, trail from Río Sidro, 800–1400 ft., 78°49′W, 9°23′N, 18 Dec. 1980, *Sytsma et al. 2639* (MO); trail to Cerro Obu (Habu of maps) from Río Urgandi (Río Sidra), 100–300 m, 9°23′N, 78°48′W, 24 June 1986, *de Nevers et al. 7967* (MO, PTBG). **Darién:** Parque Nacional del Darién, Estación Rancho Frío at N base of Cerro Pirre, ca. 9 km S of El Real, 8°01′N, 77°44′W, 70–270 m, 8 Oct. 1987, *Hammel et al. 16108* (COL, MO, PTBG); Parque Nacional del Darién, trocha hacia Cerro Pirre, 8°00′N, 77°45′W, 500–700 m, 8 Feb. 1991, *Herrera et al. 898* (MO, PTBG); Parque Nacional del Darién, ridge between N and S branches of Río Pucuro, across from old Tacarcuna village, 8°01′N, 77°16′W, 600–1000 m, 21 Oct. 1987, *Hammel et al.*

16341 (COL, MO, PTBG); Cerro Tacarcuna, S slope, 1250–1450 m, ridge top forest below summit, 26 Jan. 1975, *Gentry & Mori 13923* (MO); Ensenada del Guayabo, 18 km SE of Jaqué, 13 Jan. 1983, *Garwood et al. 205* (MO); N slopes and flatlands of Río Jaqué Valley, along Quebrada Luka, 7°27′N, 78°05′W, 0–300 m, 24 Jan. 1982, *Knapp & Mallet 3131* (MO); Río Cuasi, main stream, 0–2.5 mi. S of Tres Bocas, 28 Apr. 1968, *Kirkbride & Duke 1139* (MO). **Panamá:** Cerro Jefe, 15 Apr. 1971, *Croat 14433* (MO); Camino de Llano a Cartí, 14–18 km de la carretera a Chepo, 400 m, 20 Feb. 1973, *Correa et al. 1881* (MO); El Llano–Cartí Road, 10 km from Interamerican Hwy., 5 Oct. 1974, *Mori & Kallunki 2332* (MO), 8 mi. from Pan-American hwy., 09°15′04″N, 79°00′04″W, 225–275 m, 16 Feb. 1987, *McPherson 10486* (MO, PTBG); 8 km N of El Llano on El Llano–Cartí Road, E of Río Terable, 450 m, 9°15′N, 78°50′W, 19 Aug. 1981, *Knapp 945* (MO); 25 km NE of Cerro Azul on Río Piedras, Gorgas Memorial Labs yellow fever research camp, 550 m, 20–22 Nov. 1974, *Mori & Kallunki 3288* (MO); Mtns. above Torti Arriba, 2 Dec. 1977, *Folsom et al. 6591* (MO); Serrania de Maje, S of Choco village of Ipeti, Río Ipeti drainage system, 8°47′N, 78°27′W, 500–600 m, 11 Dec. 1981, *Knapp & Sytsma 2379* (MO); Río Piratí, foothills of Serrania de Majé, 9°00′N, 78°35′W, 100–150 m, 16 May 1982, *Knapp & Mallet 5146* (MO, PTBG); Río Maje, near Bayano Lake, 30–60 m, 4 May 1976, *Croat 39593* (MO, PTBG).

Key to the Subspecies of *Randia armata*

1a. Twigs usually armed with spines, rarely unarmed; stipules 2–6 mm long, acute apically, not strongly venose or becoming fibrous with age; calyx lobes not strongly venose, usually not persisting in fruit; flowers and fruits with pedicel (3–)5–12 mm long; fruits ellipsoidal . . *R. armata* subsp. *armata*

1b. Twigs generally unarmed, rarely with a few short spines; stipules 5–12 mm long, acuminate or aristate apically, with prominent parallel veins, becoming fibrous with age; calyx lobes with prominent parallel veins or at least costa, often reflexed and persisting in fruit; flowers and fruits sessile or the pedicels 1–3(–8) mm long; fruits spheroidal . . . . . *R. armata* subsp. *panamensis*

Acknowledgments. I thank Anna Asquith for preparing the excellent illustration. Claes Gustaffson and Charlotte M. Taylor provided helpful comments and suggestions that enhanced the clarity and accuracy of the paper.

Literature Cited

Andersson, L. 1992. A provisional checklist of neotropical Rubiaceae. Scripta Botanica Belgica 1: 1–199.

Dwyer, J. D. 1980. Rubiaceae. *In* R. W. Woodson, Jr. & R. W. Schery et al. (editors), Flora of Panama. Ann. Missouri Bot. Gard. 67: 1–522.

Lorence, D. H. & J. D. Dwyer. 1987. New taxa and a new name in Mexican and Central American *Randia* (Rubiaceae, Gardenieae). Bol. Soc. Bot. México 47: 37–48.

Taylor, C. M. & D. H. Lorence. 1993. On the status of *Randia armata* (Sw.) DC. (Rubiaceae: Gardenieae). Taxon 42: 865–867.

A New Species of *Metroxylon* (Arecaceae) from Western Samoa

Will McClatchey
University of Hawaii at Manoa, Department of Botany, Honolulu, Hawaii 96822-2279, U.S.A.

ABSTRACT. *Metroxylon paulcoxii* sp. nov., from the islands of 'Upolu and Savai'i in Western Samoa, is described, illustrated, and compared to *M. warburgii* (F. Heim) Beccari, which is also present in Samoa. *Metroxylon paulcoxii* is differentiated from *M. warburgii* by the presence of three autapomorphic characters: shorter mid-rachis leaflets, pendulous or variable rachillae, and terminal (distal) rachillae more than twice as long as lateral (proximal) rachillae. In addition, the ambiguous name *M. upoluense* Beccari is discussed.

While surveying the palms of Samoa in 1996 with Scott Zona of Fairchild Tropical Garden, Miami, specimens of *Metroxylon warburgii* (F. Heim) Beccari were collected from the islands of 'Upolu and Savai'i in Western Samoa. During the course of collecting, Samoan colleagues and guides indicated that two entities existed. Further discussions with elderly Samoans confirmed that two ethnovarieties (culturally recognized taxa) of *Metroxylon* traditionally were recognized and collectively called "niu Lotuma." Although recognized by some informants, the two ethnovarieties do not appear to have separate Samoan names. The leaves of the trees are used by Samoans as leaf thatch, and recently some individuals have learned that the stem pith can be used as a source of edible starch. Some informants indicated that the leaves of one of the two ethnovarieties were not useful for thatch. Throughout both islands, we encountered and collected herbarium specimens from isolated and mixed stands of both ethnovarieties, which appear to be sympatrically and sym-ecologically distributed. Detailed taxonomic studies, as outlined below, support the conclusion that the two entities are specifically distinct, one representing the widely distributed *Metroxylon warburgii*, and the other a Samoan endemic, here described as *Metroxylon paulcoxii*.

Morphological variation in the species of *Metroxylon* sect. *Coelococcus* has been previously considered (McClatchey, 1996), with recognition of wide variation in many vegetative and fruit characters. Much less infrataxon variation has been observed in floral and inflorescence characters. Characters observed in the field varied much more widely than those observed on herbarium specimens; therefore this research has relied more heavily upon field observations of living trees than only upon preserved materials. Previous analysis of morphological variation among populations of species of section *Coelococcus* (McClatchey, 1996) has supported the phenetic distinction of each species. These phenetic species were then used in a morphological cladistic analysis that provided a hypothesis that *M. paulcoxii* is more closely related to *M. warburgii* than to the other species of section *Coelococcus* (*M. amicarum* (H. Wendland) Beccari, *M. salomonense*, and *M. vitiense*). Only characters that consistently differentiate *M. paulcoxii* and *M. warburgii* (Table 1) have been selected for this discussion, although many more have been used in historical descriptions of the species of *Metroxylon* (Beccari, 1918). A brief synopsis of the historical record of taxonomic studies of *Metroxylon* in Samoa is provided below.

METROXYLON UPOLUENSE BECCARI, NOMEN DUBIUM

In 1905, the German botanist Rechinger sent specimens of apparently immature *Metroxylon* fruits from the island of 'Upolu, in Samoa, to Beccari in Italy, which were subsequently named *M. upoluense* Beccari. The author located these fruits in FI still in the original envelope that was used to mail them from Samoa. These fruits are pyriform in shape, as are fruits of *M. warburgii* and *M. paulcoxii*, as well as some fruits of *M. amicarum*. Beccari's (1918) description of *M. upoluense* is simply a description of immature pyriform *Metroxylon* fruits, which are unassignable to species. These may represent either *M. warburgii*, which had previously been described, or *M. paulcoxii*, which is herein described. It is also possible that the immature fruits represent *M. amicarum*, but this is improbable because this species is found in Micronesia, far to the northwest of Samoa. Thus the name *M. upoluense* Beccari, which has a type and description that cannot with confidence be determined [WESTERN SAMOA. 'Upolu Island: 1905, *Rechinger s.n.* (FI), Asiatic Palms-Lepidocaryeae Ann. Roy. Bot. Gard. (Calcutta) 12(2): 156–195. 1918] is considered to be a nomen ambiguum.

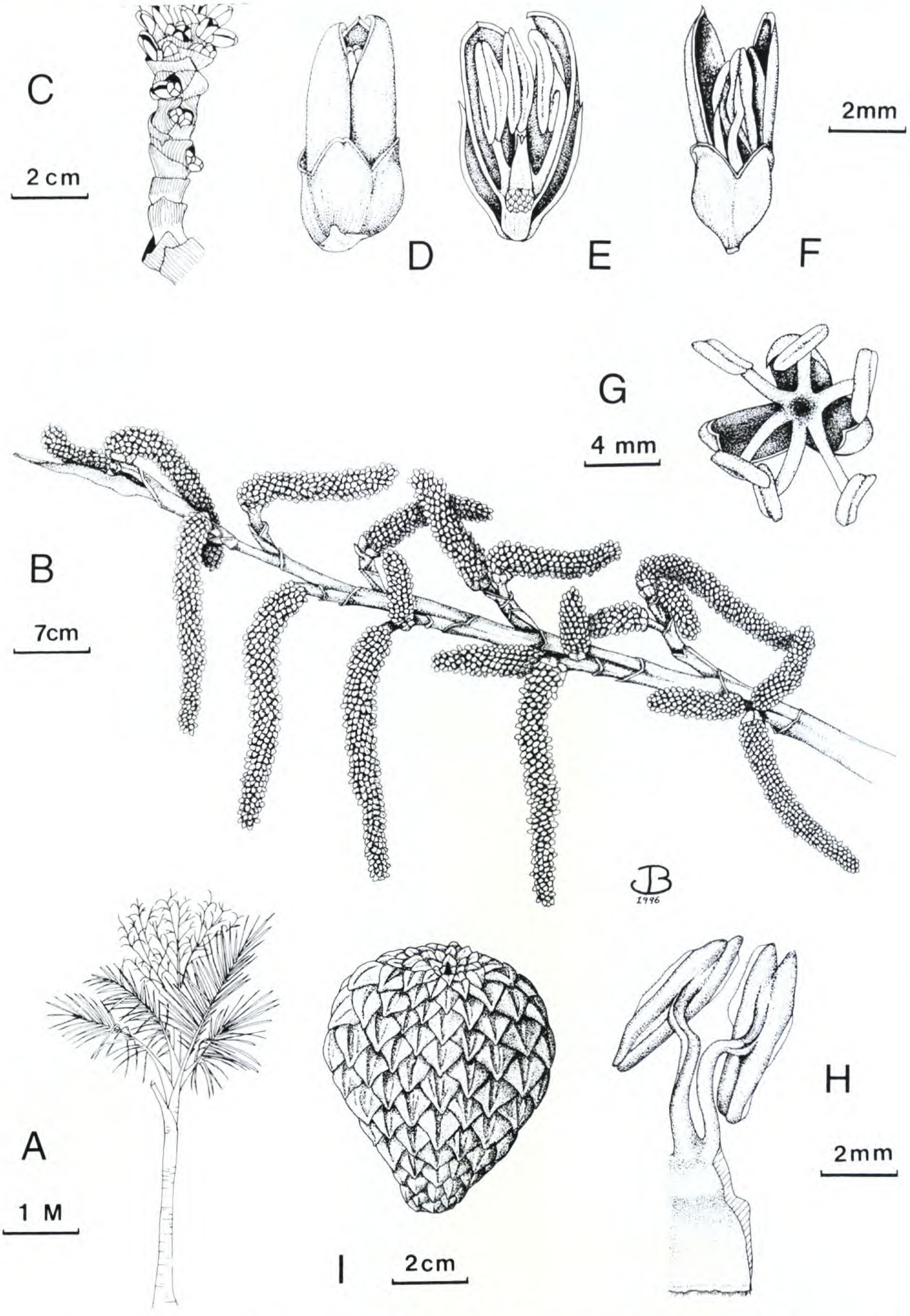


Figure 1. *Metroxylon paulcoxii* McClatchey. —A. Habit. —B. Inflorescence branch with rachillae (note pendulous, erect, and horizontal growth). —C. Distal rachilla base. —D. Hermaphroditic flower. —E. Hermaphoditic flower with sepals and a petal removed. —F. Staminate flower with a petal removed. —G. Open staminate flower. —H. Staminate flower stamens and portion of androecial tube (note medifixed anther-filament attachment). —I. Fruit. Drawn from *Moore & Fasavalu 9985* and *McClatchey et al. 1192*.

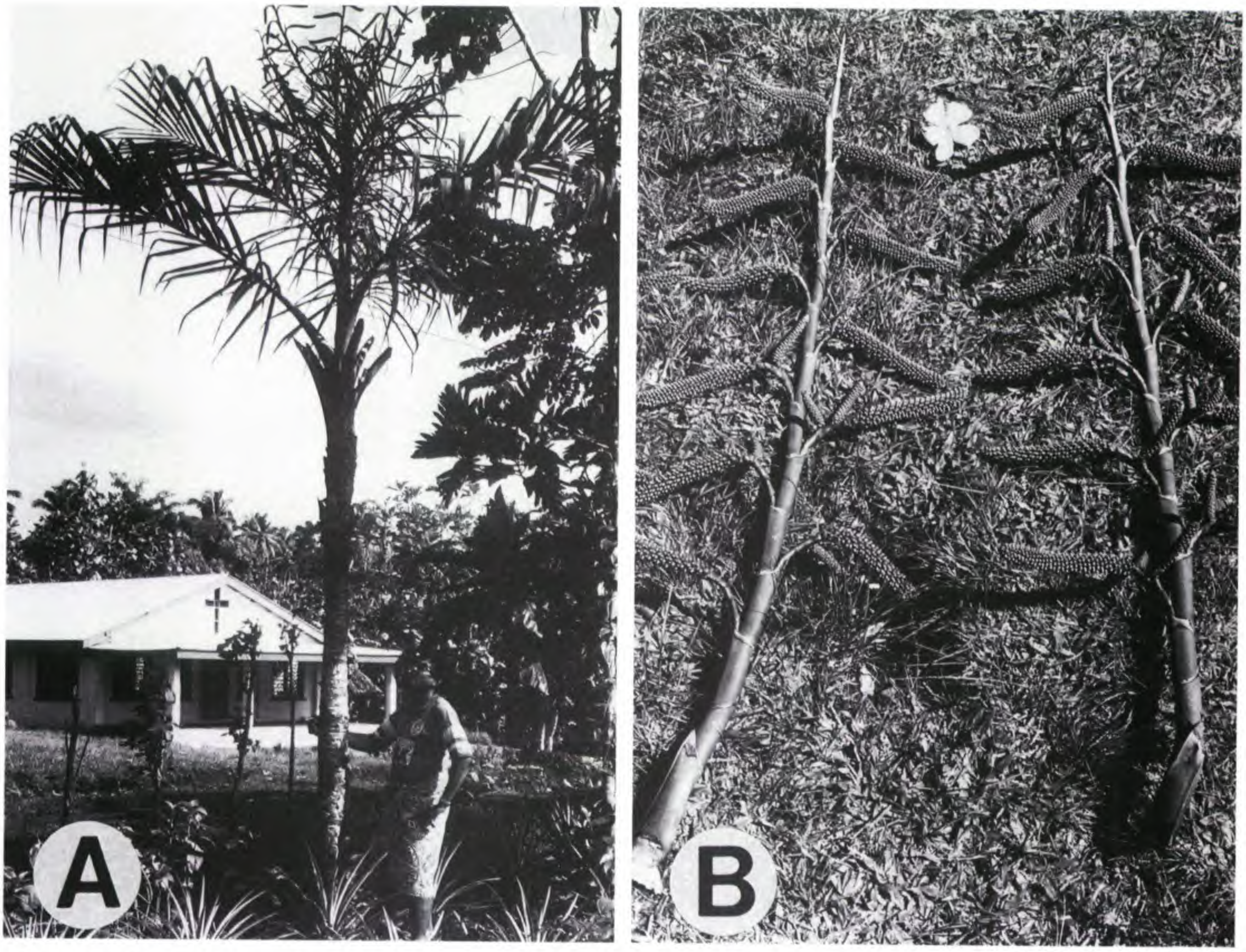


Figure 2. *Metroxylon paulcoxii.* —A. Habit. —B. Inflorescence branch with rachillae.

History of Other Collections

In the early 1970s Harold E. Moore, Jr., collected two groups of specimens from Samoa that he had identified as *Metroxylon warburgii* and *M. upoluense* Beccari. We collected *Metroxylon* at his collection localities, as well as many additional locations of lowland rainforest-swamp edges, garden hedgerows, and village sites where these trees grow. It is possibly significant that trees of both Samoan ethnovarieties were always found in areas of human activities, although human occupation sites were most common in the near swamp and wet lowland areas preferred by *Metroxylon* (Paijmans, 1980). It is likely that at least one anthropogenic introduction of *Metroxylon* into Samoa has occurred (McClatchey & Cox, 1992), but possibly more than one, either anthropogenic or natural, introductions have occurred.

Species Concepts

It is clear that Moore recognized two separate species of *Metroxylon*, calling them *M. warburgii* and *M. upoluense*. Moore typically used a phenetic species concept (Moore, 1973), depending upon character gaps to separate species. I also recognized two species but have not applied the ambiguous name *M. upoluense.* Instead, the unnamed entity is herein described and named in honor of a long-term student of Samoan botany, culture, and ecology, Paul Alan Cox.

Metroxylon paulcoxii is considered to be a cladospecies and is differentiated from its sister species, *M. warburgii*, on the basis of three autapomorphies to form a monophyletic group as determined by phylogenetic analysis (McClatchey, 1996) employing Hennig 86 (Farris, 1989): (1) Terminal (distal) rachillae more than twice as long as lateral (proximal) rachillae; (2) Longest lateral rachillae usually less than 16 cm long; and (3) Rachillae erect, horizontal, and pendulous on each branch with the two species sharing a single synapomorphy (absence of pubescence on rachillae bases/axils). *Metroxylon paulcoxii* is also phenetically distinct (Sneath & Sokal, 1973) from all other members of section *Coelococcus* and fits the diagnosable (or phylogenetic) species concept of Cracraft (1983) and Davis and Nixon (1992).

When considering the appropriate species concept to use for studies of *Metroxylon paulcoxii*, the

Figure 3. *Metroxylon warburgii* habit.

work of Rauwerdink (1986) on *M. sagu* was considered. Rauwerdink worked with a species complex that he divided into the diagnosable units of forma. This was necessary because he was working with *Metroxylon* sect. *Metroxylon*, in which asexual reproduction has apparently led to an array of rarely fertile lineages suitably considered as forma of one species. The species of *Metroxylon* sect. *Coelococcus* have never been noted as reproducing asexually, and therefore are more easily considered as sexually reproductive, biological species (Mayr, 1942; Mayr & Ashlock, 1991).

Metroxylon paulcoxii McClatchey, sp. nov. TYPE: Western Samoa. 'Upolu island: roadside between Falevao and La Mafa pass, 10 m alt., *Moore & Fasavalu 9985* (holotype, BH). Figure 1A–H.

Table 1. Morphological distinctions between *M. warburgii* and *M. paulcoxii*.

Character	*M. warburgii*	*M. paulcoxii*
Mid-rachis leaflet length	>95 cm	<95 cm
Rachillae attitude	erect (none pendulous)	variable (some to many pendulous)
Terminal: lateral rachillae length	~1:1 (<2:1)	>2:1
Inflorescence branching pattern	3rd order	2–3rd order
Leaflet thickness	0.2–0.3 mm (uniformly thick)	0.15–0.2 mm[1] (variably thick)
Position of dense leaflet fibers	abaxial surface	adaxial surface

[1]Leaflet thickness is very thin except where larger veins and bundles occur, where the leaflet may be as thick as 0.3 mm.

A speciebus *Metroxylon warburgii* (Heim) Beccari, aliis rhachillis distinguenda, rhachilla distali elongata et rhachillis lateralibus longitudine deminuentibus aut nullis, rhachillis erectiusculis, horizontalibus, vel pendulis, rhachilla distali saepiuscule pendula.

Small to moderate-sized, 5–10 m tall, solitary, hapaxanthic, polygamous trees (Fig. 1A). Stem erect, 25–45 cm diam., non-branching, the stem frequently surrounded by deteriorating, partially attached leaf sheaths. Leaves moderately large, pinnate, frequently armed with green to yellow-brown spines on the sheath, petiole, and leaflet margins and midribs; petiole 1–3 m long, unarmed or armed; rachis 1.5–2.9 m long; leaflets 120–150, 5–8 cm wide, 70–95 cm long, regularly arranged to grouped, unarmed or armed with short spines 2–5 mm long, along the margins and main vein. Inflorescences branching to second order, aggregated into a suprafoliar compound inflorescence 1–2 m tall, with 8–15 erect branches equivalent to axillary inflorescences (Fig. 1A); peduncle 0.4–1.3 m long, 5–8 cm wide; peduncular bracts 1–5; rachis longer than peduncle, 0.6–1.7 cm long, first-order branches erect with 1–8 rachillae per branch; rachillae erect, pendulous, or horizontal (Fig. 1B), lateral rachillae (if present) 7–12 mm wide, 3–11 cm long, erect, horizontal, or pendulous; terminal rachilla 11–13 mm wide, 14–26 cm long, pendulous and often sigmoid-shaped, ca. 450 flowers/terminal rachilla, each rachilla with a few to many empty proximal bracts (Fig. 1C) and no to many empty distal bracts; floral prophylls spirally arranged in 4 rows. Staminate flowers 3 mm wide; calyx 5 mm long; corolla 8–11 mm long, with 3 (occasionally 4), woody, valvate (occasionally imbricate) petals (Fig. 1D); corolla more than twice as long as the calyx (Fig. 1E, F); stamens 6 mm long, medifixed and joined at the base into an androecial tube (Fig. 1G, H). Hermaphroditic flowers 3 mm wide; calyx 5 mm long, sepals as in staminate flower; corolla 8–9 mm long, petals as in staminate flower; corolla as in staminate flower; stamens 5 mm long; gynoecium 2.5 mm long (Fig. 1E). Fruit pyriform, 5.4–6 cm diam. (Fig. 1I), 6.5–7 cm long, with emergent apical stigmatic remains; epicarp covered in 24–26 rows of green to golden yellow-brown to gray margined, reflexed scales, with the mid-fruit scales 13 mm long; mesocarp 2 mm or more thick, fibrous, corky or spongy, becoming much thicker toward the fruit base; endocarp thin. Seed globose, 3.7 cm wide, basally attached, invaginated up to 20 mm deep with a thin sarcotesta; endosperm homogenous (ivory white); embryo basal. Germination adjacent-ligular; eophyll pinnate. Cytology unknown.

Discussion

Although *Metroxylon warburgii* and *M. paulcoxii* are found growing in the same ecosystems on the same islands (sometimes side by side), they are readily distinguishable, even from a distance. Their distributions, however, are at least in part due to human plantation activities; therefore the sympatric distribution may simply be an artifact of human actions rather than ecological similarities.

Metroxylon paulcoxii (Fig. 2) is distinguished from *M. warburgii* (Fig. 3) by the following characters: (1) Mid-rachis leaflets shorter than 95 cm long vs. mid-rachis leaflets longer than 95 cm long in *M. warburgii*. (2) Rachillae pendulous, horizontal, or only some erect vs. rachillae mostly erect with some horizontal. (3) Terminal (distal) rachilla: lateral (proximal) rachilla length ratio greater than 2:1 and some (commonly terminal) rachillae pendulous vs. terminal rachilla: lateral (proximal) rachilla length ratio less than 2:1 (Table 1).

Inflorescences of *Metroxylon warburgii* are always branched to the third order, whereas those of *M. paulcoxii* are typically only branched to the second order (Fig. 4). This appears to be part of a reduction trend in *M. paulcoxii*, where the lateral rachillae have been reduced in size and number or

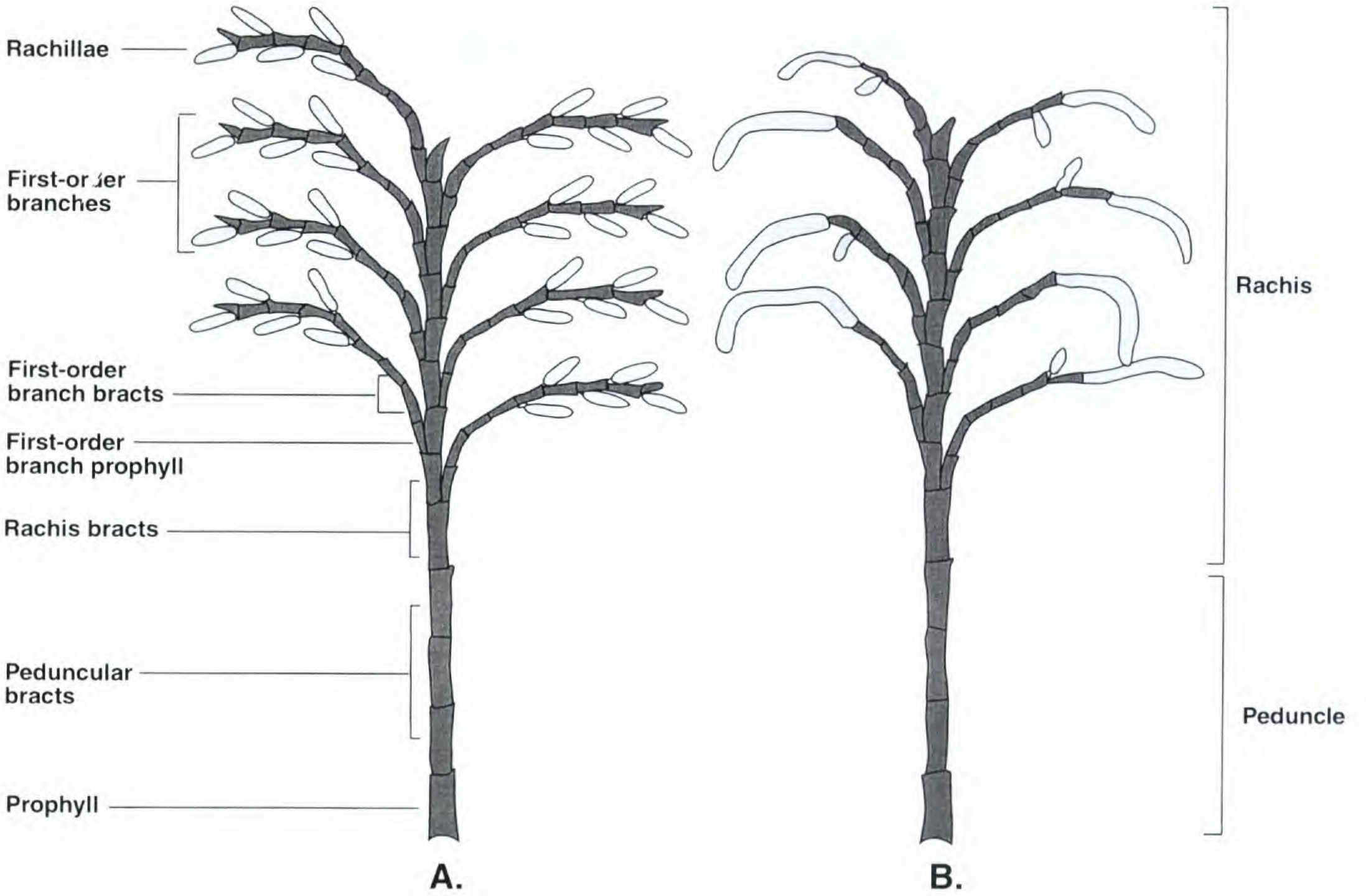


Figure 4. Diagrammatic illustration of *Metroxylon* inflorescence branches. —A. Branching pattern of *M. warburgii*. —B. Branching pattern of *M. paulcoxii*.

are entirely absent as compared to specimens of *M. warburgii*. At the same time, there appears to be an increase or dominance in the distal rachilla, which is lengthened through extended growth and maturation of bracts and flowers at its base. One specimen of *M. paulcoxii*, *McClatchey, Zona & Poai 1192*, has inflorescence branches that have a few secondary branches that resemble *M. warburgii*, while the remaining branches resemble *M. paulcoxii*. This may represent a hybrid or may merely represent part of the morphological variability of *M. paulcoxii*.

Preliminary anatomical studies indicate that *Metroxylon warburgii* and *M. paulcoxii* also differ in their leaf anatomy. Leaflets of *M. warburgii* are thicker (0.2–0.3 mm vs. 0.15–0.2 mm), less variable in thickness (*M. paulcoxii* is highly variable, thicker where bundles are located, sometimes locally up to 0.3 mm thick, and thinner between bundles), and contain larger bundles of non-lignified fibers. Furthermore the fibers of *M. paulcoxii* are distributed with greater numbers occurring under the hypodermis of the abaxial side of the leaflet, whereas greater numbers of fibers are located under the adaxial surface of leaflets of *M. warburgii*.

Paratypes. Although H. E. Moore, Jr., typically collected duplicates of specimens, no isotypes of *Moore 9985* have been located. WESTERN SAMOA. **Savai'i:** tapu elieli, *McClatchey, Zona, Poai, Schuster & Tipamaa 1192* (BH, BISH, BRY, FTG, K), *McClatchey, Zona & Schuster 1193* (BH, BISH, BRY, FTG, K). **'Upolu Island:** Mafa pass, Lotofaga Uta, *McClatchey & Zona 1186* (BH, BISH, BRY, FTG, K); Tuamasaga, Le au va'a uta, *McClatchey, Zona, Tipamaa & Poai 1198* (BH, BISH, BRY, FTG, K).

Acknowledgments. This research was supported by Fairchild Tropical Garden and the McGinty Fellowship, University of Florida. The author thanks Kelly Barber, Paul Cox, Walter Judd, Valerie McClatchey, Kilita Petelo, Kalati Poai, Cedric Schuster, William L. Stearn, Toni Tipamaa, Art Whistler, and Scott Zona. Artwork has been provided by Janet Bielling Zugar. Herbarium materials were provided by B, BM, BISH, BRY, FTG, FI, FLAS, and K.

Literature Cited

Beccari, O. 1918. Asiatic Palms—Lepidocaryeae, the Species of the Genera. Ann. Roy. Bot. Gard. (Calcutta) 12(2): 156–195.

Cracraft, J. 1983. Species concepts and speciation analysis. Current Ornithology 1: 159–187.

Davis, J. I. & K. C. Nixon. 1992. Populations, genetic variation, and the delimitation of phylogenetic species. Syst. Biol. 41: 421–435.

Farris, J. S. 1989. Hennig86. Port Jefferson Station, New York.

Mayr, E. 1942. Systematics and the Origin of Species. Columbia Univ. Press, New York.

——— & P. D. Ashlock. 1991. Principles of Systematic Zoology, 2nd ed. McGraw-Hill, New York.

McClatchey, W. C. 1996. A Revision of the Genus *Metroxylon* section *Coelococcus* (Areacaceae). Ph.D. Dissertation, University of Florida, Gainesville, Florida.

——— & P. A. Cox. 1992. Use of the sago palm *Metroxylon warburgii* in the Polynesian Island, Rotuma. Econ. Bot. 46: 305–309

Moore, H. E., Jr. 1973. The major groups of palms and their distribution. Gent. Herb. 11: 27–141.

Paijmans, K. 1980. Ecological notes on sago in New Guinea. Pp. 9–12 *in* W. R. Stanton & M. Flach (editors), Sago: The Equatorial Swamp as a Natural Resource. Proceedings of the Second International Sago Symposium. Martinus Nijhoff Publishers, The Hague.

Sneath, P. H. A. & R. R. Sokal. 1973. Numerical Taxonomy. W. H. Freeman, San Francisco.

Sinopsis del Género *Lacmellea* (Apocynaceae) en Mesoamérica, con una Nueva Especie de Costa Rica

J. Francisco Morales
Instituto Nacional de Biodiversidad, Apto. 22-3100, Santo Domingo de Heredia, Costa Rica

RESUMEN. El género *Lacmellea* en Mesoamérica es tratado en una breve sinopsis. En adición, una nueva especie de *Lacmellea* de Costa Rica, *L. zamorae*, es descrita e ilustrada.

ABSTRACT. A brief synopsis of the genus *Lacmellea* in Mesoamerica is provided. Keys, exsiccatae, and descriptions are included. In addition, a new Costa Rican species of *Lacmellea*, *L. zamorae*, is described and illustrated.

Lacmellea H. Kartsten es un género con cerca de 20 especies distribuidas principalmente en Sur América (Monachino, 1944). Este género se caracteriza por su hábito arbóreo o arbustivo, hojas opuestas, lóbulos del cáliz eglandulares, anteras no conniventes ni aglutinadas a la cabeza del pistilo y frutos bayas carnosas, con 1–4 semillas.

El último tratamiento para las especies mesoamericanas fue publicado por Woodson (1938), donde él reconoció 2 especies, una de ellas incluida en el género *Zschokkea*, posteriormente relegado a la sinonimía de *Lacmellea*. Sin embargo, la exploración y el incremento de la recolección de especímenes botánicos en regiones poco exploradas ha incrementado el número de especies reportadas para el área. Por otro lado, recientes estudios en la inexplorada vegetación de las Fajas Costeñas del Pacífico Sur de Costa Rica, situadas entre Acosta y Quepos, han revelado una nueva especie de *Lacmellea*.

Por tal razón, se brinda a continuación una breve sinopsis de la especies de *Lacmellea* en Mesoamérica, incluida una clave, especímenes seleccionados examinados y descripciones para todas las especies.

LACMELLEA

Lacmellea H. Karsten, Linnaea 28: 450. 1857. TIPO: *Lacmellea edulis* Kartern.

Zschokkea Müller Argoviensis, in Mart. Fl. bras. 6(1): 20. 1860. TIPO: *Zschokkea gracilis* Müller Argoviensis.

Arboles o arbustos; tronco con o sin aguijones, usualmente con látex lechoso; ramitas teretes o algo aplanadas. Hojas corto-pecioladas, opuestas, eglandulares. Inflorescencias corimbosas o cimosas, axilares, usualmente con pocas flores, corto-pedunculadas; brácteas pequeñas y usualmente inconspicuas. Flores pequeñas blancas, blanco-crema a amarillo-crema; cáliz 5-lobulado, lóbulos imbricados, subiguales, eglandulares; corola hipocrateriforme, sin apéndices, tubo recto o algo giboso; limbo 5-lobulado, sinextrorsamente convoluto; estambres 5, incluidos, anteras libres y no aglutinadas a la cabeza del pistilo; conectivo no alargado; ginoceo compuesto por 2 carpelos sincárpicos; ovario superior; nectario anular, adnado al ovario; cabeza del pistilo más o menos cilíndrica. Frutos sincárpicos, formados por una baya carnosa y jugosa, conteniendo 1 a 4 semillas, desnudas.

Lacmellea comprende cerca de 20 especies distribuidas desde Guatemala hasta Brazil.

CLAVE PARA LAS ESPECIES DE *LACMELLEA* EN MESOAMÉRICA

1a. Hojas diminutamente pubescentes en el envés, por lo menos a lo largo de las venas; tubo de la corola fuertemente doblado en la posición de los estambres, justo antes de la boca — 4. *L. zamorae* J. F. Morales

1b. Hojas glabras en el envés; tubo de la corola ± recto o muy levemente doblado.

2a. Hojas con puntuaciones negras visibles en el envés; lámina 12–23 cm largo; lóbulos de la corola 11–14 × 3–4 mm; frutos anaranjados al madurar . . . . . 2. *L. speciosa* Woodson

2b. Hojas sin puntuaciones; lámina 4.5–15 cm largo; lóbulos de la corola 7–11 × 2–3.5 mm; frutos usualmente amarillos o rara vez anaranjados al madurar.

3a. Cáliz 3–4.5 mm ancho; sépalos ca. 2 × 3 mm; tronco sin aguijones; Honduras, Belice y Guatemala . . . . . 3. *L. standleyi* (Woodson) Monachino

3b. Cáliz ca. 2 mm ancho; sépalos 1–1.5 × 1–1.5 mm; tronco con aguijones; Sur de Nicaragua a Colombia . . 1. *L. panamensis* (Woodson) Markgraf

1. Lacmellea panamensis (Woodson) Markgraf, Notizbl. Bot. Gart. Berlin-Dahlem 15: 622. 1941. *Zschokkea panamensis* Woodson, Trop. Woods 44: 22. 1935. TIPO: Panamá. Panamá: Canal Zone, Barro Colorado Island, Feb. 1932, *Woodworth & Vestal 639* (holótipo, MO; isótipo, F; foto INB ex F).

Arboles 4–25 m; tronco con aguijones; ramitas algo aplanadas a subteretes cuando jovenes, teretes con la edad, glabras. Hojas: peciolo 7–13 mm, glabro; lámina (4.5–)6–14 × 1.5–6 cm; angostamente elípticas, elipticas a oblongas, cartáceas, glabras; ápice abruptamente acuminado o acuminado; base obtusa o anchamente aguda. Inflorescencia axilar, 4–11 flores, glabra; pedúnculo 4–8 mm; brácteas menos 1 mm, ovadas, inconspicuas; pedicelos 2–7 mm; lóbulos del cáliz 1–1.5 × 1–1.5 mm, obtusos a redondeados, glabros; corola hipocrateriforme, blanca o amarillo-crema, glabra; tubo 1.7–2.4 × 0.2 mm en la boca, ca. 0.2 cm basalmente, recto, esparcidamente pubescente en el interior; lóbulos 8–1.2 × 2.5–3.5 mm, ovado-elípticos; estambres insertos; filamentos glabrados a puberulentos, inconspicuos; anteras ca. 4 mm. Frutos 2.5–3 cm diámetro, anchamente ovoides a suborbiculares, amarillos o anaranjados al madurar, glabros, comestibles.

Esta especie se encuentra distribuida desde Belice hasta Colombia, entre 0–700 m. Florece enero a octubre; fructifica todo el año.

Lacmellea panamensis (Woodson) Markgraf puede distinguirse de *L. standleyi* por su cáliz y lóbulos más angostos. Es la especie más común en Mesoamérica, donde se conoce localmente como "Lagarto negro," por su corteza negra, con numerosos aguijones.

Especímenes seleccionados examinados. NICARAGUA. Río San Juan, Campamento La Lupe, 15 km NE del Castillo, *Grijalva 5609* (CR, HNMN, INB). COSTA RICA. **Heredia:** Parque Nacional Braulio Carrillo, *Aguilar et al. 159* (CR, INB, MO, NY). **Limón:** Barra del Colorado, Sardinas, *Araya 768* (CR, INB, MO). **Puntarenas:** Península de Osa, Fila a Cerro Chocuaco, *Marín 450* (CR, F, INB, MO). **San José:** Zona Protectora La Cangreja, Santa Rosa de Puriscal, *Morales et al. 850* (CR, INB, MO). PANAMA. **Chiriquí:** Burica Peninsula, *Croat 22187* (MO). **Panamá:** Barro Colorado Island, *Croat 5035* (F, MO); San Blas, near Puerto Obladia, *McPherson 6947* (MO); Barro Colorado, *Woodworth et al. 3818* (F, MO).

2. Lacmellea speciosa Woodson, Ann. Missouri Bot. Gard. 36: 543. 1949. TIPO: Colombia. Del Valle: Río Calima (región del Chocó), La Trojita, feb.–mar. 1944, *Cuatrecasas 16568* (holótipo, MO; isótipos, COL, F, US; foto INB ex F).

Arboles 6–18 m; tronco sin aguijones; ramitas aplanadas cuando jovenes, subteretes con la edad, glabras. Hojas: peciolo (2–)4–16 mm, glabro; lámina 12–23 × 3.5–9 cm; elipticas a oblongas, cartáceas, glabras, usualmente con conspicuas puntuaciones negras en el envés; ápice abruptamente acuminado; base obtusa o anchamente aguda. Inflorescencia axilar, 4–12 flores, glabra; pedúnculo 2–11 mm; brácteas 1.5–2.5 mm, ovadas, inconspicuas; pedicelos 2–9 mm; lóbulos del cáliz 1.5–2 × 1.5–2 mm, obtusos a redondeados, glabros; corola hipocrateriforme, verde-amarillo a crema, glabra; tubo 2.3–3 × 0.2 mm en la boca, ca. 0.2 cm basalmente, recto, esparcidamente pubescente en el interior; lóbulos 11–14 × 3–4 mm, oblongos; estambres insertos; filamentos glabrados a puberulentos, inconspicuos; anteras ca. 4 mm. Frutos 3–3.7 cm diámetro, anchamente ovoides a suborbiculares, amarillos al madurar, glabros, comestibles.

Esta especie se encuentra distribuida desde el Sur de Costa Rica hasta Colombia, Ecuador y Perú, entre 600 y 1100 m. Florece abril a noviembre; fructifica julio a noviembre.

Lacmellea speciosa Woodson puede reconocerse fácilmente por sus hojas grandes y conspicuamente negro-punteadas. Conocida previamente hasta Panamá, es ahora reportada en Costa Rica, donde ha sido colectada principalmente en la vertiente atlántica de la Cordillera de Talamanca y más recientemente en las fajas costeñas de Acosta, Quepos y Parrita (Pacífico Sur).

Especímenes selecionados examinados. COSTA RICA. **Limón:** Fila Tsiurabeta, entre Ríos Urén y Lari, *A. Chacón 299* (CR, MO, USJ); Talamanca, Río Sukut y Río Carbri, *Herrera 3284* (INB, MO). **San José:** Acosta, San Jerónimo, *Morales 3180* (CR, INB, MO), *3185* (CR, INB, MO). PANAMA. **Bocas Del Toro:** along road above Chiriqui Grande, *McPherson 7334* (MO). **Darién:** S of El Real–Alturas de Nique, *McPherson 11573* (MO). **Panamá:** Cerro Jefe region, *McPherson 15259* (MO).

3. Lacmellea standleyi (Woodson) Monachino, Lloydia 7: 285. 1944. *Zschokkea standleyi* Woodson, in Standley, Publ. Field Mus. Nat. Hist., Bot. ser. 22: 44. 1940. TIPO: Guatemala. Izabal: Entre Ríos, 30 Apr. 1939, *Standley 72587* (holótipo, MO; isótipo F; foto INB ex F).

Arboles 5–12 m; ramitas aplanadas cuando jovenes, teretes o subteretes con la edad, glabras; tronco sin aguijones. Hojas: peciolo 6–10 mm, glabro; lámina (6–)8–15.5 × 2.3–5 cm; angostamente elípticas, elípticas a oblongas, subcartáceas, glabras; ápice abruptamente acuminado; base obtusa a redondeada. Inflorescencia axilar, 4–10 flores, glabra; pedúnculo 4–11 mm; brácteas 1 mm, ovadas, inconspicuas; pedicelos 3–8 mm; lóbulos del cáliz 2 × 3 mm, redondeados, glabros; corola hipocrateriforme, blanca a blanco-crema, glabra; tubo 2–2.5 × 0.3 mm en la boca, ca. 0.2 cm basalmente, recto, pubescente en el interior; lóbulos 7–10 × 2–3 mm, ovado-lanceolados; estambres insertos; filamentos

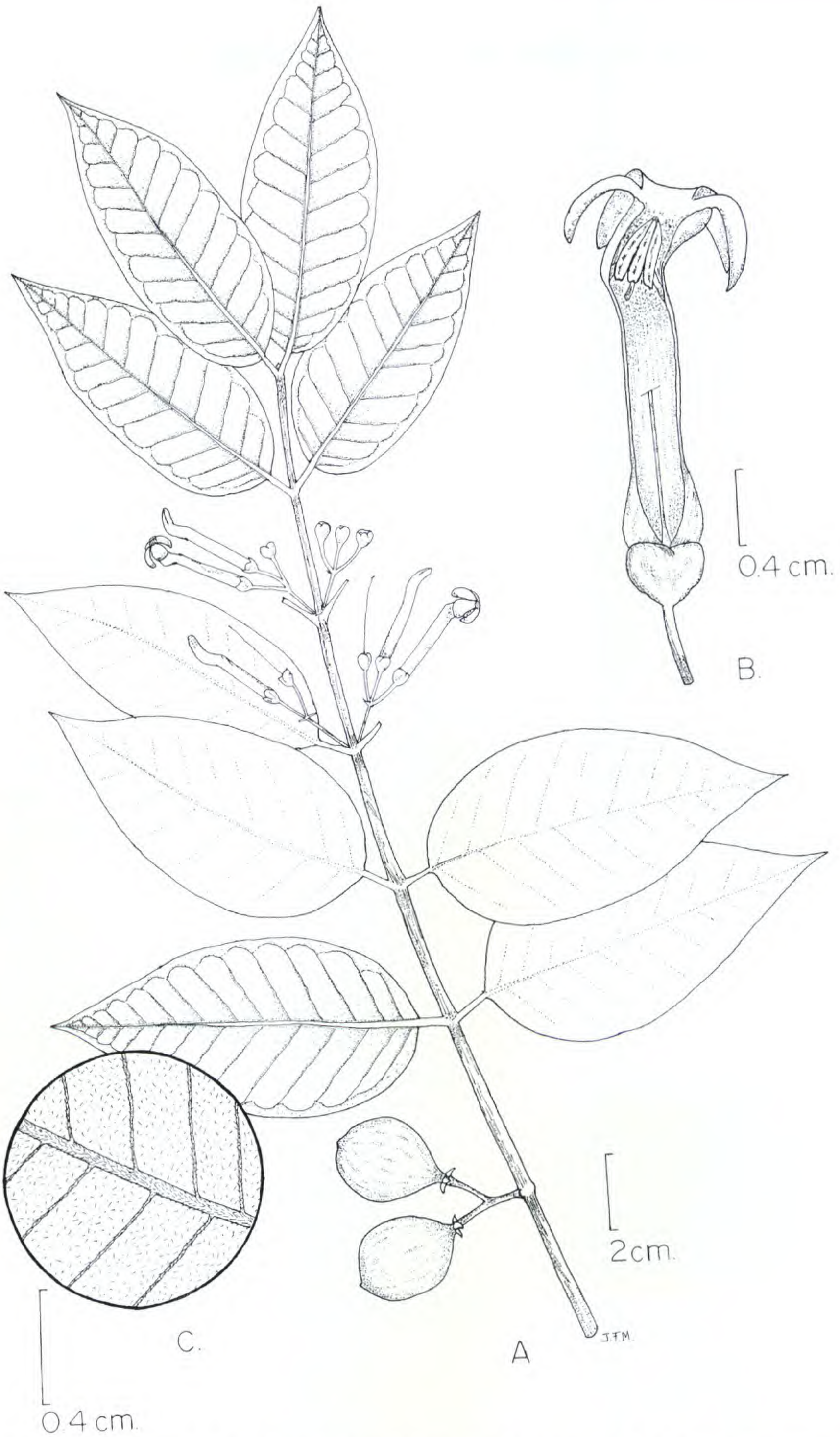


Figura 1. A–C. *Lacmellea zamorae* J. F. Morales (*Morales 3618*). —A. Hábito. —B. Corola abierta, mostrando estambres. —C. Pubescencia de las hojas.

glabrados a puberulentos, inconspicuos; anteras 5–6 mm. Frutos 1.5–2.3 cm diámetro, anchamente ovoides, amarillos al madurar, rara vez amarillo-anaranjados, glabros, comestibles.

Esta especie es conocida en Guatemala, Honduras y Belize, entre 0 y 500 m. Florece marzo a junio. Fructifica junio a septiembre.

Lacmellea standleyi está cercanamente relacion-

ada a *L. panamensis*, pero se reconoce fácilmente por su cáliz y lóbulos más anchos y tronco usualmente sin espinas.

Especímenes seleccionados examinados. GUATEMALA. **Izabal:** NW of Lake Izabal, *Abarca 1550* (INB); between Virginia and Lago Izabal, Montaña del Mico, *Steyermark 38886* (F, INB, MO, NY); Izabal, Cerro San Gil, along Rio Frio, *Steyermark 41635* (MO). BELIZE. **Toledo:** Rio Grande, *Gentle 4682* (F, MO, NY); Rio Grande, *Schipp 1234* (F, MO). HONDURAS. **Yoro:** SE del Valle Lean, near Placencia, *Hazlett et al. 2743* (EAP, INB, MO).

4. Lacmellea zamorae J. F. Morales, sp. nov. TIPO: Costa Rica. San José: Cantón de Tarrazú, Faja Costeña del Valle de Parrita, bosques remanentes en la falda W del cerro Hormiguero, 900 m, 28 feb. 1995, *Morales 3618* (holótipo, INB; isótipos, BM, CR, F, INPA, K, MO, NY, P, US, WAG, Z). Figura 1.

Species nova quae a *L. standleyi* (Woodson) Monachino foliis puberulis, calycis laciniis 1–1.5 × 3 mm, corollae tubo 3.6 × 0.3 cm, antheris 3–4 mm longis differt.

Arbol 3–6 m; tronco sin aguijones; ramitas subteretes, esparcidamente puberulas. Hojas: peciolo 5–10 mm, diminutamente puberulo; lámina 6–12 × (2.5–)3.3–5.8 cm; elípticas, angostamente elipticas o angostamente ovadas, membranáceas; glabras a glabradas en el haz; diminutamente puberulas en el envés, sobretodo a lo largo del nervio central, rara vez glabradas; ápice agudo, acuminado o largo acuminado; base obtusa; margen involuto. Inflorescencia cyma corymbosa reducida o fasciculada, axilar, con 1–3(–5) flores; pedúnculo 3–9 mm; brácteas 1–2 mm, ovadas, conspicuas; pedicelos 6–9 mm, ambos esparcidamente pubérulos o glabrados; lóbulos del cáliz 1–1.5 × 3 mm, redondeados, glabros; corola hipocrateriforme, crema, glabra; tubo 3.6 × 0.3 cm en la boca, ca. 0.3 cm basalmente, abultado en la base, fuertemente doblado justo en la posición de los estambres, formando un ángulo de casi 45 grados respecto al tubo, pubescente en el interior; lóbulos 9 × 4–5 mm, angostamente ovados; estambres insertos; filamentos glabros, inconspicuos; anteras 3–4 mm, curvadas. Frutos 2–3 cm diámetro, orbiculares o suborbiculares, anaranjados al madurar, glabros, comestibles; semillas 1.2–1.5 cm × 7–8 mm, elípticas a angostamente elípticas, lisas.

Conocida hasta el momento sólo para Costa Rica, entre 700 y 1300 m. Florece febrero a marzo; fructifica febrero a agosto.

En el género *Lacmellea*, *L. zamorae* es la única especie con el envés de las hojas pubescente. *Lacmellea zamorae* J. F. Morales es bastante similar a *L. standleyi* (Woodson) Monachino, del norte de Centroamérica, de la cual se puede separar además de la pubescencia de sus hojas, por la forma del tubo de la corola y el largo de las anteras y lóbulos del cáliz. Difiere de *L. panamensis* (Woodson) Markgraf, la especie más común en el sur de Mesoamérica, por el tamaño del cáliz y corola. Adicionalmente, *L. zamorae* presenta inflorescencias usualmente con 1 a 3(–5) flores, mientras las otras especies presentan inflorescencias multifloras, con 4–12 flores.

Lacmellea zamorae se encuentra en bosques nubosos y lluviosos, característicos de las fajas montañosas costeras del Pacífico Sur de Costa Rica, donde se desarrolla en asociaciones muy ricas en especies de Bromeliaceae y Orchidaceae principalmente. La cercanía de las llanuras costeras, la gran humedad y el abrupto cambio en elevación en pocos kilómetros, así como la rápida intergradación entre diversas asociaciones boscosas y el aislamiento geográfico a que estan sometidas, convierten estas zonas en áreas propensas al endemismo.

El epiteto está dedicado a Nelson Zamora (INB), quien fue el primer en recolectar dicha especie, como reconocimiento a sus aportes para el conocimiento de la flora costaricense y por su apoyo personal.

Paratipos. COSTA RICA. **San José:** Perez Zeledón, Las Nubes, Santa Elena, *Alfaro 496* (CR, INB, MO); Fila Costeña, Fila Tinamastes, *Hammel et al. 20209* (CR, INB, MO); San Isidro de Tarrazú, *Zamora et al. 1429* (CR, INB, MO).

Literatura Citada

Monachino, J. 1944. A revision of *Lacmellea* and the transfer of *Zschokkea* (Apocynaceae). Lloydia 7: 275–302.

Woodson, R. E. 1938. (Asclepiadales) Apocynaceae. *In* J. H. Barnhart (editor), North American Flora 29(2): 179–185. The New York Botanical Garden, New York.

Three New Species and a New Combination in *Vallesia* (Apocynaceae)

J. Francisco Morales
Instituto Nacional de Biodiversidad (INBio), Apto. 22-3100, Santo Domingo de Heredia, Costa Rica

ABSTRACT. Three new species of *Vallesia*, *V. sinaloensis*, *V. spectabilis*, and *V. vaupesana*, are described. In addition, a new combination, *Vallesia aurantiaca* (M. Martens & Galeotti) J. F. Morales, is proposed. New synonymies are also provided.

In the process of preparing the Apocynaceae treatment for the *Flora Mesoamericana*, the following novelties were found.

Vallesia aurantiaca (M. Martens & Galeotti) J. F. Morales, comb. nov. Basionym: *Neriandra (?) aurantiaca* M. Martens & Galeotti, Bull. Acad. Roy. Sci. Bruxelles 11: 356. 1844. TYPE: Mexico. Veracruz: Santiago de Huatusco, Apr. 1841 (fl), *Galeotti 1591* (holotype, BR; photograph INB ex BR).

Vallesia mexicana Müller Argoviensis, Linnaea 30: 393. 1859. Syn. nov. TYPE: Mexico. Veracruz: near Orizaba, Feb. 1854, *Botteri 473* (holotype, G-DC; isotype, MO; photograph INB ex G-DC).

Vallesia flexuosa Woodson, Ann. Missouri Bot. Gard. 24: 14. 1937. Syn. nov. TYPE. Costa Rica. Alajuela: Zarcero de Alfaro Ruiz, 21 Dec. 1924 (fl), *Brenes 4156* (holotype, F; isotype, CR; photograph, INB ex F).

In the last monograph of *Vallesia*, Meyer (1955) suggested the possibility that *Neriandra* (?) *aurantiaca* M. Martens & Galeotti is synonymous with *V. mexicana* Müller Argoviensis, as was pointed out by Standley (1924). Examination of the type material confirmed that *V. mexicana* must be reduced to the synonymy of *V. aurantiaca*.

In her monograph of *Vallesia*, Meyer (1955) recognized eight species, including two new species and two varieties. However, her thesis was never published. Therefore, these two unpublished names are validly published here.

Vallesia sinaloensis E. Meyer ex J. F. Morales, sp. nov. TYPE: Mexico. Sinaloa: Quebrada de Plátano, Sierra Monterrey, *Gentry 5907* (holotype, MO; isotypes, GH, NY, UC; photograph INB ex MO).

Arbor parva, ramulis maturitate fuscis. Folia elliptica vel auguste-elliptica, 7–11.5 × 2.5–3.5(–4) cm, subtus tomentulosa, apice acuminata. Inflorescentiae subumbelliformes, subterminales. Corollae tubo 8–10 mm, lobis 5 × 1.5–2 mm. Drupa 12–17 mm.

Shrub 3–7 m high; branchlets tomentulose. Leaves petiolate; petiole 7–11 mm long, glabrate; blade membranaceous, elliptic to narrowly elliptic, 7–11.5 × 2.5–3.5(–4) cm; acuminate at the apex, acute basally; upper surface glabrate, lower surface tomentulose; tertiary veins anastosoming beneath; stipules acute. Inflorescence subterminal, many-flowered, subumbelliform, glabrate; peduncle 6–11 mm long; pedicels 2.5–3 mm; bracts scarious and inconspicuous. Flowers: sepals broadly ovate, 1–1.5 × 1 mm, acuminate, glabrous; corolla salverform, inflated near the orifice, yellowish, glabrous without; tube 8–10 mm long; lobes very narrowly elliptic, 5 × 1.5–2 mm, obtuse to somewhat acute; stamens sessile or subsessile, inserted near the orifice of the tube; anthers narrowly ovate, ca. 2 mm long, apiculate; ovary 1–1.5 mm; style head cylindric, ca. 1 mm, bifid. Fruits obovate, 12–17 mm long; seeds unknown.

This species occurs in northwestern Mexico, in the state of Sinaloa, where it grows at elevations of 900–1000 m.

Vallesia sinaloensis could be confused with *V. spectabilis* but is easily distinguished by its tomentulose leaves beneath and smaller flowers.

Vallesia spectabilis E. Meyer ex J. F. Morales, sp. nov. TYPE: Mexico. San Sebastian, *Mexia 1915* (holotype, MO; isotypes, F, GH, NY, UC, US; photograph INB ex F).

Arbor parva, ramulis maturitate glabris. Folia elliptica vel auguste-elliptica, 10–15 × 3–4.5 cm, glabra, apice acuminata. Inflorescentiae subumbelliformes, subterminales vel terminales. Corollae tubo 11–13 mm, lobis 4–5 × 2 mm. Drupa 13–17 mm.

Shrub 4–7 m high; branchlets glabrous. Leaves petiolate; petiole 7–10 mm long, glabrous; blade firmly membranaceous, elliptic to narrowly elliptic, 10–15 × 3–4.5 cm; acuminate at the apex, obtuse

basally; glabrous; tertiary veins anastomosing; stipules not seen. Inflorescence terminal or subterminal, many-flowered, subumbelliform, agglomerate; peduncle 9–15 mm long; pedicels 3–4 mm; bracts scarious and inconspicuous. Flowers: sepals ovate, 1–1.5 × 1 mm, acute to acuminate, glabrous; corolla salverform, inflated near the orifice, in the position of the stamens, white, glabrous without; tube 11–13 mm long; lobes very narrowly elliptic, 4–5 × 2 mm, obtuse to somewhat acute; stamens sessile or subsessile, inserted near the orifice of the tube; anthers narrowly ovate, ca. 1.5 mm long, apiculate; ovary 1–1.5 mm; style head cylindric, ca. 1 mm, bifid. Fruits reniform to obovate, 13–17 mm long; seeds unknown.

Vallesia spectabilis is known from Mexico, where it is restricted to the State of Jalisco, at 1300–2100 m.

This species is vegetatively quite similar to *Vallesia mexicana* Müller Argoviensis but differs by its larger flowers and fruits. Additionally, *V. spectabilis* is distinguished from *V. sinaloensis* by its glabrous leaves.

Paratypes. MEXICO. **Jalisco:** Sierra de Manantlán Occidental, between Puerto del Picacho de San Campus and Cerro Las Chilillas, 25 Dec. 1984, *Judziewicz et al. 4978* (USF, WIS not seen); trail from Sebastian to Arroyo Seco, *Mexia 1435* (CAS, F, GH, MO, NY, UC).

Vallesia vaupesana J. F. Morales, sp. nov. TYPE. Colombia. Vaupes: Mitú and vicinity, lower Río Paraná–Pichuna, savanna at major rapids, 10 Sep. 1976, *Zarucchi 2016* (holotype, INB; isotype, COL).

Arbuscula, ramulis puberulis. Folia auguste-ovata vel auguste-elliptica, 0.7–2.4 × 0.3–1.4 cm, apice acuta vel obtusa, glabra, coriacea. Inflorescentiae corymbosae, subterminales. Corollae tubo 1–1.5 mm, lobis 2.5–3 × 1 mm. Drupa 6–8 mm.

Shrub less than 1 m high; branchlets densely and minutely puberulent when young, glabrate when fully mature. Leaves petiolate; petiole 1–2(–3) mm long, minutely puberulent to glabrate; blade coriaceous to subcoriaceous, narrowly ovate to narrowly elliptic, 0.7–2.4 × 0.3–1.4 cm; acute to obtuse at the apex, obtuse to obscurely cordate basally; glabrous to glabrate on both sides; secondary veins inconspicuous. Inflorescence subterminal, many-flowered, somewhat spreading, not agglomerate, minutely puberulent; peduncle 3–6 mm long; pedicels 1.5–2.5 mm; bracts scarious and inconspicuous. Flowers: sepals broadly ovate, less than 0.3 mm, rounded, glabrous; corolla salverform, greenish to yellowish, glabrous without; tube 1–1.5 mm long; lobes very narrowly elliptic, 2.5–3 × 1 mm, acute; stamens sessile or subsessile, inserted near the orifice of the tube; anthers suborbicular, ca. 0.7 mm long, obtuse to somewhat retuse; ovary ca. 0.5 mm; style head subglobose, ca. 0.3 mm, inconspicuously bifid. Fruits subglobose, 6–8 mm long, solitary, orange; seeds unknown.

This species is currently known only from Colombia, in the Vaupes and Guainia states, but probably will be found in the Amazon basin in Brazil and Venezuela.

Vallesia vaupesana is easily distinguished by its small habit, small leaves, open inflorescence, and suborbicular fruits, a combination of characters unique in the genus.

Paratypes. COLOMBIA. **Guainía:** Puerto Inírida, Río Inírida, 14 Aug. 1975, *García-Barriga 20820* (COL, INB). **Vaupes:** savanna de Yapobodá, near Maloca of Yararáca, Alto Cuduyarí, 10 Dec. 1943, *Allen 3198* (COL), *Allen 3206* (COL).

Acknowledgments. I thank the curators and directors of the following herbaria for the loan of material: A, COL, CR, ENCB, F, GH, HUA, MO, NY, US, and USJ.

Literature Cited

Meyer, E. 1955. The genus *Vallesia*, A Systematic Study. Masters's Thesis, Washington University, St. Louis, Missouri.

Standley, P. C. 1924. Trees and shrubs of Mexico. Contr. U.S. Natl. Herb. 23: 1151.

New Names in *Plectranthus* (Lamiaceae) and Allied Genera from the Ethiopian Region

J. K. Morton
Department of Biology, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1

ABSTRACT. The following new combinations are made: *Plectranthus burorum* (Chiovenda) J. K. Morton based on *Coleus burorum* Chiovenda, *P. garckeanus* (Vatke) J. K. Morton based on *C. garckeanus* Vatke, *P. grandicalyx* (E. A. Bruce) J. K. Morton based on *C. grandicalyx* E. A. Bruce, *P. kapatensis* (R. E. Fries) J. K. Morton based on *C. kapatensis* R. E. Fries, *Isodon schimperi* (Vatke) J. K. Morton based on *P. schimperi* Vatke, *Solenostemon autrani* (Briquet) J. K. Morton based on *C. autrani* Briquet, and *S. porpeodon* (J. G. Baker) J. K. Morton based on *P. porpeodon* J. G. Baker. Also two new names are put forward, *P. puberulentus* J. K. Morton to replace *C. gracilis* Gürke and *P. pseudobarbatus* J. K. Morton to replace *C. vestitus* J. G. Baker.

The genus *Coleus* has been included in *Plectranthus* by most recent workers (e.g., Adams, 1972; Agnew, 1974; Codd, 1975; Brummitt, 1992) following the proposals of the present author (Morton, 1962). Also *Solenostemon* and *Isodon* are regarded as separate genera, distinct from *Plectranthus* (Morton, 1962; Codd, 1975; Li, 1988; Ryding, 1992, 1993). As part of a revision of the Ethiopian species in this group of genera, several new names and combinations are needed in order to bring the account into line with current generic concepts. The following changes are proposed.

Plectranthus burorum (Chiovenda) J. K. Morton, comb. nov. Basionym: *Coleus burorum* Chiovenda, Fl. Somalia 278. 1929. TYPE: Somalia. Boscaglia di Bur Budulca, *Puccioni & Stefanini 287* (holotype, FT) [an excellent specimen with mature calyces and leaves].

Coleus cicatricosus J. Hutchinson & E. A. Bruce, Kew Bull. 1941: 180, 1941. TYPE: Somalia. Buramo at 4200 ft., *Gillett 4880* (holotype, K; isotype, FT) [the holotype is an excellent specimen of 2 sheets with flowers, mature calyces, and leaves].

Plectranthus garckeanus (Vatke) J. K. Morton, comb. nov. Basionym: *Coleus garckeanus* Vatke, Linnaea 37: 323. 1872. TYPE: Ethiopia. Gonder region, Begember in the valley of the R. Repp and on mountains 7–8000 ft., *Schimper 1193* (holotype, B destroyed; isotype, K) [the isotype is an excellent flowering specimen].

Plectranthus salviiflorus Chiovenda, Malpighia 34: 516, 1937. SYNTYPES: Ethiopia. Shoa region, Abeba Kollo, *Taschdjian 124* (FT), Boyi near Kardobi, 2469 m, *Taschdjian 188* (FT).

Plectranthus grandicalyx (E. A. Bruce) J. K. Morton, comb. nov. Basionym: *Coleus grandicalyx* E. A. Bruce, Hooker's Icon. Pl. series 5; 4, t. 3391, 1939. TYPE: Sudan. Imatong Mts., 2400 m, *Thomas 1800* (holotype, K).

Plectranthus kapatensis (R. E. Fries) J. K. Morton, comb. nov. Basionym: *Coleus kapatensis* R. E. Fries, Wiss. Ergebnisse der schwedischen Rhodesia–Kongo Expedition 1911–12 unter Leitung von Eric Graf von Rosen, 1: 283, 1916. TYPE: Zambia. Bangweolo, Kapata Peninsula near Kamindas, *Fries 871* (holotype, UPS; isotype, K).

Plectranthus pseudobarbatus J. K. Morton, nom. nov. Replaced name: *Coleus vestitus* J. G. Baker, Kew Bull. 1895: 224, 1895. Not *P. vestitus* Bentham, Labiatarum genera et species part I, 32. 1832. TYPE: Somalia. *Cole s.n.* (lectotype, here designated, K) [excluding *Lort-Phillips s.n.* on same sheet, cited by Baker as a syntype, which is *P. lanuginosus* (C. F. F. Hochstetter ex Bentham) Agnew].

Plectranthus puberulentus J. K. Morton, nom. nov. Replaced name: *Coleus gracilis* Gürke, Bot. Jahrb. Syst. 38: 170 incl. fig. 2, 1906. Not *P. gracilis* Suessenguth, in Proc. & Trans. Rhodesia Sci. Assoc. 43: 126, 1951. SYNTYPES: Somalia. Gebüsch, *Ellenbeck 965* (B destroyed); Ethiopia. *Riva 1564* (FT).

Isodon schimperi (Vatke) J. K. Morton, comb. nov. Basionym: *Plectranthus schimperi* Vatke, Linnaea 37: 317, 1872. SYNTYPES: Ethiopia. Gonder region, Gaffat, 8100 & 8200 ft., *Schimper 1174* (P not seen, K) and *1179* (K).

This species is similar to *Isodon ramosissimus* (J. D. Hooker) Codd and is included in it by Codd (1984). It is not mentioned by Li (1988) in his revision of the genus. Unlike *I. ramosissimus*, it is subglabrous and larger in all its parts, with a trun-

cate, instead of round, leaf base. Based on the description, *P. schimperi* Chiovenda, Malphigia 34: 517, 1937, a later homonym, is a synonym, too.

Solenostemon autrani (Briquet) J. K. Morton, comb. nov. Basionym: *Coleus autrani* Briquet, Bull. Herb. Boissier 2: 129, Feb. 1894. TYPE: Ethiopia. Without locality, *Schimper 693* (holotype, P; isotype, K).

Coleus shirensis Gürke, Bot. Jahrb. Syst. 19: 216, Mar. 1894. SYNTYPES: Malawi. Without locality, 1891, *Buchanan 376* (K), *602b* (K); Mt. Mlanje, *Whyte s.n.* (K).

Coleus silvaticus Gürke ex H. G. A. Engler, Abh. Preuss. Akad. Wiss. 51, May 1894, name only; full description in Bot. Jahrb. Syst. 19: 213, Aug. 1894. SYNTYPES: Tanzania. Usambara, *Holst 3704* (B destroyed), *3708* (B destroyed).

Solenostemon zambesiacus J. G. Baker, in Thiselton-Dyer, Fl. of Trop. Africa 5: 421, 1900. SYNTYPES: Malawi. Shire highlands near Blantyre, 1897, *Last s.n.* (K); between Shibisa and Tshinmujo, 2000–4000 ft., *Kirk s.n.* (K).

Coleus ostinii Chiovenda, Ann. Bot. (Rome) 9: 125, 1911. SYNTYPES: Ethiopia. Gonder region, Amhara-Dembia between Gonder and Fenter, *Chiovenda 1450* (FT) [a good specimen with flowers and mature calyces]; Cococc valley above Gondar, *Chiovenda 1854* (FT not seen).

Coleus darfurensis R. D. Good, J. Bot. 62: 138, 1924. TYPE: Sudan. Jebel Marra, *Lynes 4c* (holotype, BM [2 sheets]).

Solenostemon darfurensis (R. D. Good) B. F. Mathew, Kew Bull. 25: 258, 1971.

Solenostemon sylvaticus (Gürke) Agnew, Upland Kenya Wild Flowers 640, 1974.

Solenostemon shirensis (Gürke) Codd, Bothalia 11, 4: 440, 1975.

Solenostemon porpeodon (J. G. Baker) J. K. Morton, comb. nov. Basionym: *Plectranthus porpeodon* J. G. Baker, in Thiselton-Dyer, Fl. Trop. Africa 5: 525, Dec. 1900. *Plectranthus microphyllus* J. G. Baker, in Thiselton-Dyer, Fl. Trop. Africa 5: 410. Not *Plectranthus microphyllus* Gürke, Bot. Jahrb. Syst. 28: 467, July 1900. TYPE: Tanzania. Magila, *Kirk s.n.* (holotype, K).

Solenostemon porpeodon is part of the *S. latifolius* complex. The complex is widely distributed in tropical Africa where it is represented by many ecological and geographical forms, the taxonomic and nomenclatural status of which is unclear. At the present time a conservative approach to the taxonomy of the group seems to be appropriate, pending a comprehensive study of the complex over its entire range of distribution. Typical *S. latifolius* is an erect, somewhat weedy annual herb, whereas *S. porpeodon* is a decumbent perennial with thicker leaves and a larger, more showy corolla. It is associated with openings in the forest and rocky outcrops. *Solenostemon thyrsiflorus* (J-P. A. Lebrun & A. Toussaint) Vollesen is a similar, usually more pubescent, plant from savanna habitats in central Africa, which may be conspecific with *S. porpeodon.*

Acknowledgments. I am grateful to the directors of the following institutions for permission to use their herbarium and library facilities: BM, E, ETH, FI, FT, K, PRE, and UPS. I am also indebted to Alan Paton for useful discussions about the genus *Plectranthus* and its allies.

Literature Cited

Adams, C. D. 1972. Flowering Plants of Jamaica. Univ. West Indies, Mona.

Agnew, A. D. Q. 1974. Upland Kenya Wild Flowers. Oxford Univ. Press, Oxford.

Brummitt, R. K. 1992. Vascular Plant Families and Genera. Royal Botanic Gardens, Kew.

Codd, L. E. 1975. *Plectranthus* (Labiatae) and allied genera in Southern Africa. Bothalia 11(4): 371–442.

———. 1984. The genus *Isodon* (Schrad. ex Benth.) Spach in Africa and a new genus *Rabdosiella* Codd (Lamiaceae). Bothalia 15(1 & 2): 7–10.

Li, H. 1988. Taxonomic review of *Isodon* (Labiatae). J. Arnold Arbor. 69: 289–400.

Morton, J. K. 1962. Cytotaxonomic studies on the West African Labiatae. J. Linn. Soc., Bot. 58(372): 231–283.

Ryding, O. 1992. Pericarp structure and phylogeny within Lamiaceae subfamily Nepetoideae tribe Ocimeae. Nordic J. Bot. 12: 273–298.

———. 1993. A reconsideration of the genus *Rabdosiella* (Lamiaceae, Neperoideae, Ocimeae). Pl. Syst. Evol. 185: 91–97.

Three New Species of *Erica* (Ericaceae) from South Africa

E. G. H. Oliver & I. M. Oliver
Compton Herbarium, National Botanical Institute, P. Bag X7, Claremont 7735, South Africa

ABSTRACT. Three new species of *Erica* from the Western Cape Province of South Africa are described and illustrated. Their probable affinities and known distributions are discussed. *Erica cabernetea* is a very restricted endemic in the Elgin Basin, *E. navigatoris* is known only from two well-separated inland mountains, and *E. cedromontana* occurs widespread in the Cedarberg mountains on rock faces.

The genus *Erica* L., occurring from Norway to southern Africa, currently comprises 760 species, of which 90% are endemic in the southern part of South Africa. Our research on the genus in this region has revealed numerous new species that need to be described formally and species complexes that need to be resolved. Despite the large number of species known, it is sometimes difficult to ascertain the precise affinities of new species with our present knowledge of the genus.

Erica cabernetea E. G. H. Oliver, sp. nov. TYPE: South Africa. Western Cape: 3418BD, Caledon District, Elgin area, Arieskraal, slopes above the Klein Palmiet River, 800 ft. (244 m), 9 Nov. 1970, *Oliver 3188* (holotype, NBG; isotypes, BM, BOL, E, K, MO, NY, P, PRE, S). Figure 1.

Fruticulus parvus compactus, unicaulis. Rami pilis paucis brevibus reflexis et glandibus subsessilibus. Folia ternata oblonga breve apiculata anguste sulcata pilis paucis praecipue in apice; petiolum appressum, glabrum, ciliolatum. Flores ternati 1–2(3)fasciculati terminales breve racemosi; bractea mediana lanceolata ad linearis, sulcata, glabra, glandibus subsessilibus; bracteolae 2 bracteae similes. Calyx quadripartitus, segmentis oblongis anguste et longe sulcatis, sulcus ad basim late et distincte V-formis, breve apiculatis marginibus puberulis et glandibus subsessilibus elongatis. Corolla quadrilobata, cyathiformis ad semiglobosa, glabra, atrovinosa, lobis erectis triangularibus suberosis. Stamina 8 inclusa; filamenta linearia glabra, flexu sigmoideo; antherae bipartitae, subbasifixae, ovatae, thecae late ovato-ellipticae calcaris decurrentibus angustis; pollen in tetradis. Ovarium quadriloculare, late obovoideum stipa lata brevi, emarginatum, glabrum, ovulis 2 vel 3 in quoque loculo erectis in columella basali; stylum inclusum rectum glabrum; stigma capitata. Capsulum obovoideum tenellum, seminibus ellipsoideis luteis alveolatis.

Compact, rounded, much-branched shrublet 100–150 mm tall, single-stemmed reseeder. *Branches* numerous, up to 10 mm long with no, or rarely few, secondary branchlets of the same season, internodes 1.0–1.5 mm long with a few very short reflexed hairs and a few subsessile glands, becoming glabrous when old. *Leaves* ternate, imbricate to subspreading, 4.0 × 0.8 mm, oblong, shortly apiculate, adaxially flattened, abaxially rounded and narrowly sulcate with a distinct acute edge, the younger with very short scattered hairs especially on the margins and apex, glabrous when old, edges ciliolate and with short-stalked, white, nonsticky glands; petiole appressed, about 0.6 mm long, glabrous, ciliolate. *Inflorescence*: flowers 3-nate in 1–2(–3) whorls, in a condensed terminal raceme on most branches; pedicel 5 mm long, minutely puberulous, red; bract partially recaulescent in middle position, 1.5 × 0.3 mm, lanceolate to linear, sulcate for ⅓ its length, glabrous, edges with subsessile glands, mostly reddish, occasionally with apex green; bracteoles 2, about ¾ up pedicel, 1.2–1.5 × 0.3 mm, lanceolate or oblanceolate, otherwise like the bract. *Calyx* 4-partite, segments overlapping slightly at base, 1.6–2.1 × 0.7 mm, oblong, narrowly sulcate for most of their length flaring out into distinct V-shape at base, apex shortly apiculate, puberulous toward edges, edges lined with subsessile nonsticky white elongate glands, reddish green to dark red, shiny when dry. *Corolla* 4-lobed, 4.2 × 4.2 mm, cyathiform to semiglobose, glabrous, deep wine-red, lobes erect triangular, subacute, edges entire to slightly erose. *Stamens* 8, included; filaments ⅓ as long as corolla, linear widening slightly toward apex, with very marked sigmoid bend below anther, glabrous, white; anthers bipartite, subbasifixed, ovate, smooth, golden brown, appendiculate; thecae 1.0 × 0.7 mm, broadly ovate-elliptic; spurs decurrent along apex of filament, narrow, just shorter than theca, straight, pendulous to spreading abaxially due to sigmoid bend of filament; pollen in tetrads. *Ovary* 4-locular, 1.6 × 1.2 mm, broadly obovoid with a short broad basal stipe surrounded by dark red nectaries, emarginate, glabrous, red, shiny; ovules 2 or 3 per locule, erect from a placenta on basal half of columella; style included, straight, as long as ovary, glabrous; stigma capitate. *Capsule* obovoid up to 3 mm long, the

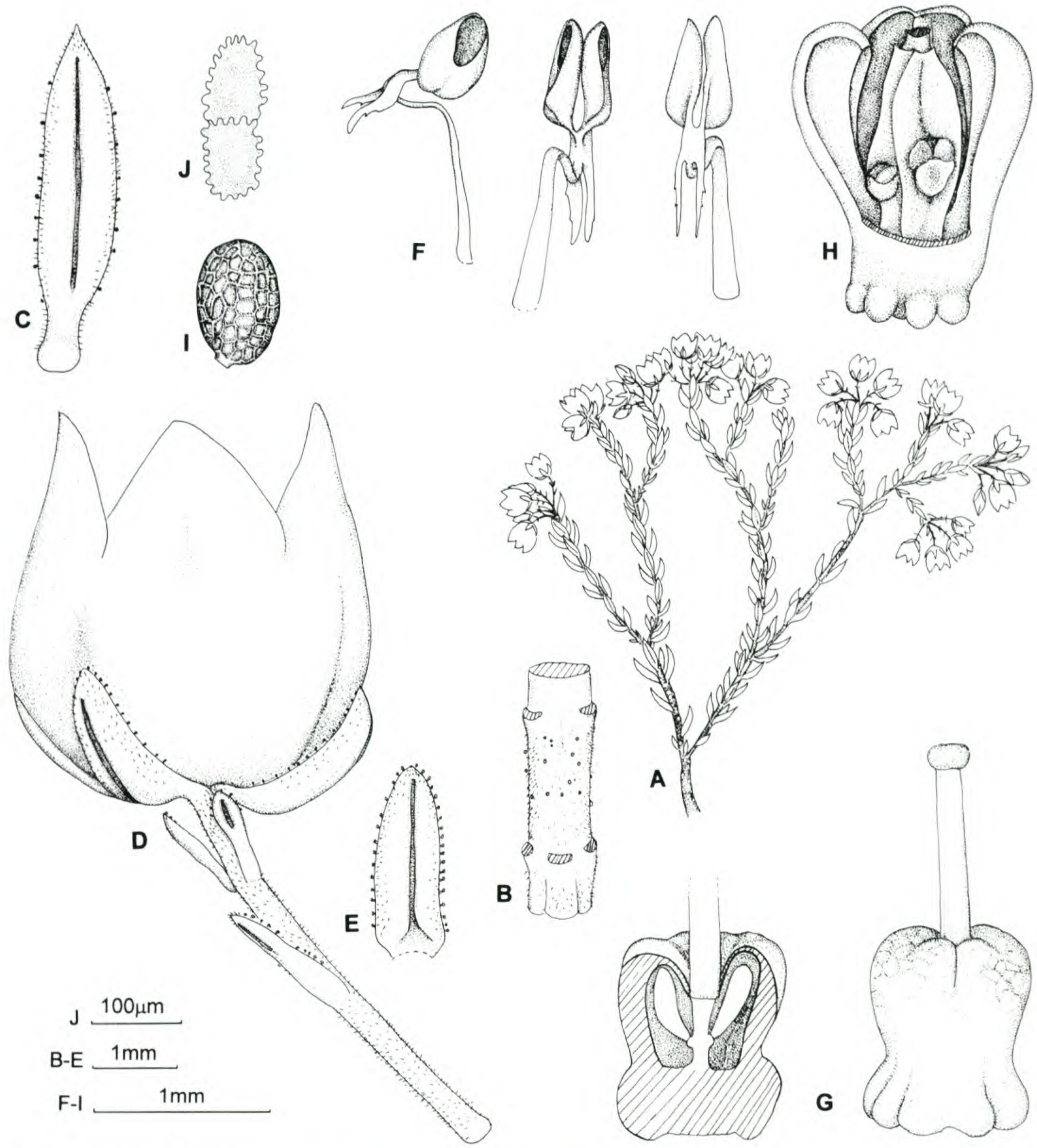


Figure 1. *Erica cabernetea* E. G. H. Oliver. —A. Flowering branch, natural size. —B. Stem. —C. Leaf. —D. Flower. —E. Sepal. —F. Stamen, side, front, and back views. —G. Gynoecium (right), with ovary cut in half longitudinally. —H. Capsule, with one valve removed. —I. Seed. —J. Testa cells. All drawn from the type collection, *Oliver 3188* (del. Inge Oliver).

valves delicate, not much thickened, the septa well developed and mostly on the columella; seeds ellipsoid, yellow, alveolate, testa cells subequal with undulate anticlinal walls, pits present.

This new species is closely allied to *Erica extrusa* Compton in having the few erect basally attached ovules, apiculate sepals and leaves, decurrently spurred anthers, and long-sulcate sepals with a characteristic V-shaped basal portion to the sulcus. It can, however, easily be distinguished from that species by the wine-red flowers (not white to pale pink), short broad stipe below the ovary (not sessile), leaves shortly apiculate (not long apiculate), narrow brown spurs (not broad, lobed white spurs), lack of conspicuous ridges between the sepals, and less hairy stems. Both species are endemic to the same small area.

These two species have an affinity with the complex formed by *Erica curvirostris* Salisbury and *E. lateralis* Willdenow because of the distinctive

shape of their sepals with their narrow sulcus and distinct V-shaped basal portion. *Erica curvirostris* and *E. lateralis*, however, both have 21 pendulous ovules per locule. When Compton described *E. extrusa* he did not ally his species to any other one, but placed it in section *Hermes* with hesitation—"separating it from other species of the section *Hermes* (into which, as a matter of fact, it does not fit very well)." Within section *Hermes* it has a number of characteristics in common with *E. collina* Guthrie & Bolus from the Hermanus area, with its basally ridged corolla, only 4 ovules per locule, and bipartite anthers, but that species has the ovules erect, a nonemarginate ovary, plumose hairs on the pedicel, leaves that are not apiculate or incurved apically, and the bract being always nonrecaulescent. In both *E. extrusa* and *E. cabernetea* the flowers are borne in condensed terminal racemes with the bract partially recaulescent quite unlike those in section *Hermes*. It would appear that the relationships of these two species from the Elgin Basin lie in section *Orophanes* with *E. curvirostris* and *E. lateralis*.

The flowers of *Erica cabernetea* are a dark wine-red color and when held up to the light are reminiscent of a glass of vintage cabernet sauvignon wine (*-eus*: indicates material or color or resemblance in quality). This dark color is unusual in *Erica* and is shared by only a few rather unrelated species such as *E. sicifolia* Salisbury, *E. haematocodon* Salter, *E. cunoniensis* E. G. H. Oliver, *E. atrovinosa* E. G. H. Oliver, the very localized Rooi Els form of *E. pulchella* Houttuyn, and one of the many color forms of *E. mammosa* L. The significance of this color in these species cannot be explained at present. These species occur in very different habitats, from sandy flats to high-altitude rocky slopes to moist rock ledges. *Erica mammosa* is the only one with a large tubular flower that in its other color forms is known to be bird pollinated. No pollinators were recorded visiting the plants of *E. cabernetea*, whose flowers were noticeably inconspicuous to the human eye due to their dark color and the very white background of the quartzitic sand.

Both of the related species, *Erica cabernetea* and *E. extrusa*, are highly restricted endemics occurring only on the sandy, quartzitic flats and lower slopes in the Arieskraal/Somersfontein area of the apple-growing Elgin basin (Fig. 2). In this area they are likely to become rare due to the reduction of their habitat for agriculture and major water-storage dams. The Elgin basin is a high-rainfall zone due to the convergence of good winter- and summer-rainfall patterns in that specific part of the Western Cape. Both form low compact, sometimes almost cushion-like, plants in open places between tussocks of Restionaceae and low sclerophyll shrublets.

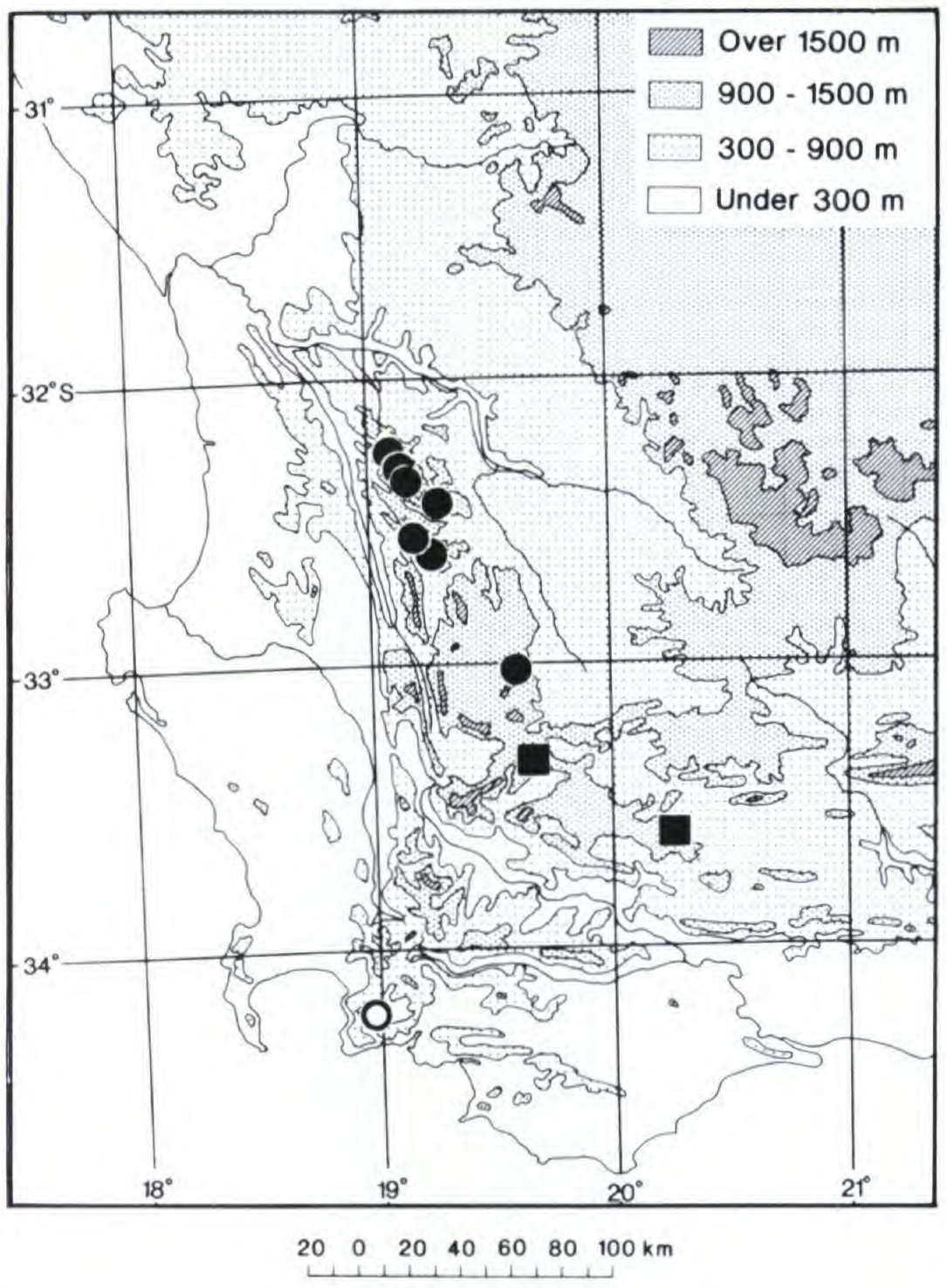


Figure 2. Known distribution of *Erica cabernetea* (open circle), *Erica cedromontana* (solid circles), and *Erica navigatoris* (squares).

Paratypes. SOUTH AFRICA. **Western Cape:** 3418: (–BB), Arieskraal Farm, underneath powerlines entering from Somersfontein after crossing the Klein Palmiet River, 140 m, 21 Oct. 1995, *Rode 519* (NBG); (–BB/BD), Palmiet River, Elgin, Dec. 1941, *Stokoe 7956* (BOL), *Stokoe sub SAM 55108* (SAM); Caledon Div., Palmiet River valley, Jan. 1943, *Stokoe* 8559 (BOL); Elgin, between Grabouw & the Paardeberg, Dec. 1947, *Stokoe in SAM 62478* (SAM); (–BD), Elgin area, NE corner of 3418BD near Somersfontein, 800 ft. (244 m), 19 Sep. 1969, *Boucher* 714 (NBG, PRE).

Erica cedromontana E. G. H. Oliver, sp. nov. TYPE: South Africa. Western Cape: 3219AC, Central Cedarberg, Langberg, SW-slopes, cracks under small overhangs on rock faces below summit, 1820 m, 7 Dec. 1995, *Oliver 10683* (holotype, NBG; isotype, PRE). Figure 3.

Fruticulus minimus multiramulosus incanus. Rami brevissimi fragilissimi puberuli pilis reflexis et pilis paucis longissimis simplicibus. Folia ternata ovata ad elliptica late sulcata puberula incana et pilis paucis longissimis simplicibus. Flores ternati in fasciculo unico in ramulis terminales; pedicellus 1.0–1.3 mm longus, puberulus; bractea partim recaulescens parva in medio pedicello;

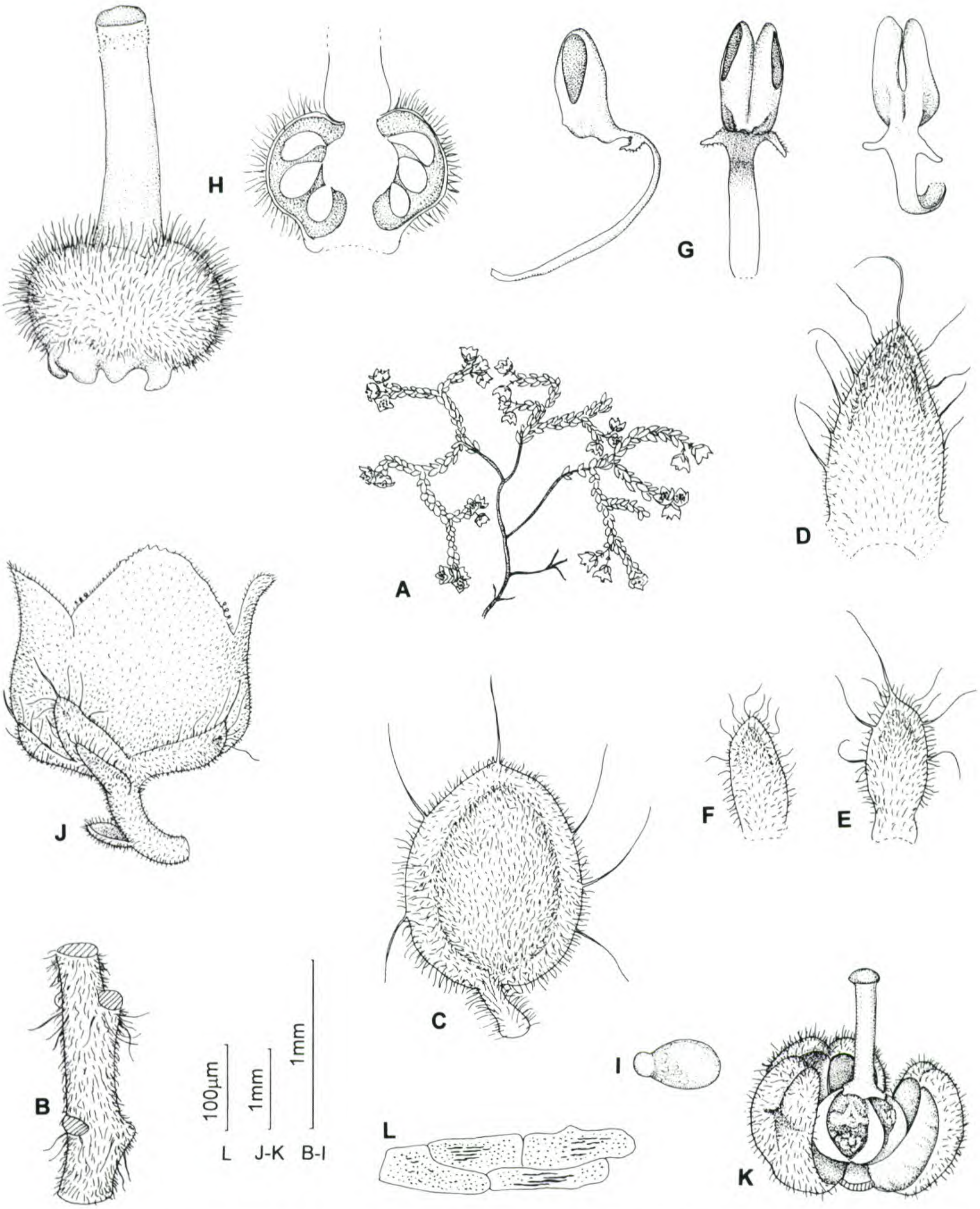


Figure 3. *Erica cedromontana* E. G. H. Oliver. —A. Flowering branch, natural size. —B. Stem. —C. Leaf. —D. Sepal. —E. Bract. —F. Bracteole. —G. Stamen, side, front, and back views. —I. Seed. —J. Flower. —K. Capsule, with one valve removed. —L. Testa cells. All drawn from the type collection, *Oliver 10683* (del. Inge Oliver).

bracteolae 2, in medio pedicello ad approximatae. Calyx quadrilobatus, puberulus et pilis paucis longisssimis simplicibus. Corolla quadrilobata cyathiformis puberula alba ad roseorubra. Stamina 8 libera inclusa; filamenta curvata; antherae appendiculatae, calcaribus parvis in filamentis decurrentibus; pollen in tetradis. Ovarium quadriloculare, puberulum, emarginatum, ovulis 4–6 in quoque loculo; stylum inclusum; stigma truncata. Fructus capsularis seminibus glabris nitidis croceis, elaiosoma alba.

Small, much-branched, matted gray shrublet to 50 × 80 mm, rarely larger, single-stemmed. *Branches* numerous, very short, brittle, terminating

in florescences, puberulous with reflexed hairs and a few much longer, slender, simple (rarely gland-tipped) hairs mostly at nodes. *Leaves* ternate, suberect to spreading, longer than internodes, 1.5 × 0.8–1.0 mm, broadly ovate to broadly elliptic, semi-openbacked with revolute margins, sulcus very wide, puberulous all over and with a few very long straight to straggly hairs toward the margins, rarely gland-tipped, apex subacute; petiole appressed, 0.3 mm long, puberulous. *Inflorescence*: flowers 3-nate in 1 whorl at ends of branchlets ca. 10 mm long; *pedicel* 1.0–1.3 mm long, puberulous, dull red; bract partially recaulescent in about the middle position, 0.8 mm long, elliptic, broadly sulcate for ½ its length or nonsulcate, puberulous abaxially with a few long simple or gland-tipped hairs on margins, dull red; *bracteoles* 2, from middle position to approximate to calyx, 0.7 mm long, otherwise like bract. *Calyx* 4-lobed, 1.3 × 0.7 mm, only slightly fused at base, adpressed to corolla, lobes ovate with subacute apex, broadly sulcate for ½–¾ their length, not imbricate, entire, puberulous abaxially and with long thin straggly simple or gland-tipped hairs on margins, greenish to dull red. *Corolla* 4-lobed, 2.5 × 2.7 mm, cyathiform, the mouth not contracted, puberulous outside, when fresh white tinged pinkish red mainly on upper side and toward the lobes becoming pinkish red all over, turning yellow to orange-red when dry; lobes erect, about twice the length of tube, subacute, margin erose and fringed with short hairs and toward the base a few short-stalked glands. *Stamens* 8, free, included; filaments oblong, broad, 1.3 mm long, markedly curved, glabrous; *anthers* dorsifixed near base, bilobed, 0.7 × 0.3 mm, oblong, appendiculate; thecae erect and adpressed, laterally narrowly oblong-elliptic, yellowish brown, spurs attached on filament below thecae, 0.15 mm long, semispreading, narrow, ciliolate, pore half the length of theca; *pollen* shed as tetrads. *Ovary* 4-locular, 0.8 × 1.1 mm, oblate, emarginate, puberulous, green, with nectaries around the base; ovules 4–6 per locule, pendulous to spreading from a central placenta; *style* included, 1.3 mm long, terete, slightly papillate below apex, otherwise glabrous, *stigma* simple, truncate. *Fruit* a dehiscent capsule with woody valves and the septa 50% on valve and 50% on columella; *seeds* 0.5 × 0.25 mm, ellipsoid, slightly flattened, smooth, shiny, orange, with a small white elaiosome, testa cells elongate, anticlinal walls slightly undulate, inner periclinal walls with numerous small pits. Figure 3.

This new species is distinguished by the very small brittle habit, the broad, gray, finely puberulous leaves with a few long simple hairs on the margins, the anthers with small spurs decurrent on the filament, and the small shiny orange seeds with a small white elaiosome.

Erica cedromontana is not closely related to any other species. In foliar and floral characters it has some similarities to a group of hairy-flowered species that occur in the region—*Erica cederbergensis* Compton, *E. setociliata* H. A. Baker, *E. eriocodon* H. Bolus, and *E. trichadenia* H. Bolus. These all, however, form much more robust and larger plants with sulcate leaves and do not grow in rock crevices. In *E. trichadenia* the spurs on the anthers are indeed decurrent, but the long, much stouter hairs on the leaves and floral parts are glandular, and the testa is alveolate with the anticlinal walls markedly undulate. *Erica eriocodon* is the closest in leaf type, which is more open-backed, but the anthers are a different shape and lack spurs, and the hairiness is more lanate; seeds are unknown. *Erica setociliata* is the furthest removed due to the development of the wind-pollination syndrome with accompanying modifications of the style/stigma complex and a loss of nectaries; it also has erect ovules. *Erica cederbergensis* occurs very close to the new species geographically, growing semi-erect to sprawling in the short vegetation on open slopes below the summit cliffs on Langberg. It has the same type of testa and testa cells, but lacks the elaiosome, and the anthers are not spurred.

The habit and habitat of *Erica cedromontana* are remarkable in the Cedarberg. We studied a small population of plants growing in rock crevices and on small ledges under overhangs on south-facing cliffs on Langberg. Here the plants were in deep shade, certainly for most of the day. In this shady situation, together with their hoary gray color, small size, and the grayish white lichen-covered rocks, the plants were very difficult to spot. This appears to be the case from all the other records except for that of *van Wyk 1501* (NBG, PRE), which was collected out in open ground between rocks and was therefore much larger and more erect.

This habitat and habit are similar to another species that has an outlying record in the southern Cedarberg, *E. marlothii* H. Bolus, recorded once from Gideonskop, otherwise known only from the high peaks in the Hex River mountains. It was recorded as growing in rock crevices on large boulders on the south slopes. It has open-backed leaves, but the corolla is depressed globose and glandular hairy, the sepals have sessile glands adaxially, the anthers are recurved and spurless, and the style is curved and puberulous.

Erica cedromontana is well distributed on the

highest peaks within the mountainous region of the Cedarberg from Krakadouw in the north to Gideonskop in the south, with an extension into the eastern part of the central Cold Bokkeveld at Vleiberg (Fig. 2). In its very specific habitat the biology of *E. cedromontana* requires comment. The possession of what appears to be an elaiosome on the seed would indicate that the seeds are distributed by ants. This would explain how the species is able to distribute itself locally in inaccessible crevices under overhangs. However, this does not correlate with the long-distance dispersal required between the high peaks, which can only be explained by wind dispersal. One would also assume that the highly inconspicuous plants and flowers would be visited by the selfsame ants for the pollination process. We have noted the visitation of ants to the flowers of four species of *Erica* with very low or semiprostrate shrublets and white pendulous flowers growing and flowering together on a nearby peak.

The first collection was made as early as March 1843. The full sheet in TCD has the label written in handwriting that looks very similar to that of Wallich on other collections of South African Ericaceae in Kew. This is substantiated in the entry for Nathaniel Wallich in *Botanical Exploration of Southern Africa* (Gunn & Codd, 1981): "In the early part of 1843 he accompanied the astronomer Thomas Maclear into the mountains north-west of Cape Town and to the Cedarberg." Presumably this collection was acquired by Harvey who resided at the Cape and, the following year, moved to TCD. The fragment in K clearly comes from the TCD sheet as it is labeled "E. microphylla" by Sonder who had had the TCD material on loan for the revision of the Ericaceae for his *Flora Capensis*. This work was never completed by him, and the loan was returned to TCD via K, which must have kept a fragment. Bolus saw the fragment in K and kept a flower for BOL with the comment "Eremia sp."

Paratypes. SOUTH AFRICA. **Western Cape:** 3219: (–AA), Krakadouw, crevices sheltered under overhanging rock, 5000 ft. [1525 m], 20 Oct. 1945, *Esterhuysen 12102* (BOL, NBG); (–AC), top of Sneeukop in rocks, 27 Mar. 1843, *Wallich s.n.* (TCD—BOL & K fragment); Langberg, rocky S slopes, shady rock crevices, 15 Dec. 1941, *Esterhuysen 7339* (BOL, NBG); rocky peak just N of Tafelberg, in sheltered rock crevices, 5500 ft. [1677 m], 29 Dec. 1947, *Esterhuysen 14341A* (BOL); Crystal Pool, crevices of rock face behind hut, Mar. 1933, *Stokoe 2605* (BOL), 5900 ft. [1800 m], Dec. 1941, *Stokoe SAM 55110* (SAM), *Stokoe SAM s.n.* (BOL); Sneeuwkop, Dec. 1941, *Stokoe SAM 55147* (SAM); Corridor Peak, S-facing cracks & overhangs in shade, 1800 m, 29 Nov. 1987, *Taylor 11924* (K, NBG); (–AD), Wolfberg Cracks, 3000–4000 ft. [915–1220 m], 26 Dec. 1953, *Esterhuysen 22446* (BOL), S aspect, crevices, 1220 m, 27 Dec. 1962, *Esterhuysen 29981* (BOL); plateau on Wolfberg between cracks and arch, rock crevices, 1600 m, 26 Nov. 1983, *M. van Wyk 1501* (NBG, PRE); (–CA), Apollo Peak, S aspect, crevices in massive cliffs, 5200 ft. [1586 m], 13 Dec. 1950, *Esterhuysen 18068* (BOL); (–CD), Gun Peak, upper SW slopes, boulder scree, growing flat in crack in boulder overhang in deep shade, 1450 m, 27 Oct. 1986, *Taylor 11643* (NBG). Without precise locality: Cedarberg, Mar. 1932, *Stokoe SAM 50107* (SAM). 3319: (–BA), Vleiberg, S-facing, rock crevices in overhanging rock, 1650 m, Oct. 1994, *Hitchcock s.n.* (NBG).

Erica navigatoris E. G. H. Oliver, sp. nov. TYPE: South Africa. Western Cape: 3319BC, Worcester Div., Matroosberg, steep slopes above De Doorns, SE aspect, ca. 5000 ft. (1525 m), 18 Dec. 1962, *Esterhuysen 29875* (holotype, BOL; isotypes, BM, K, MO, NBG, P, PRE, S, W). Figure 4.

Fruticulus ad 400 mm altus, unicaulis. Rami pauci erecti innovantes, cristis infra foliis, glabri vel interdum pilis minutis paucis. Folia ternata imbricata erecta ad subpatentia apice cuspidato ciliata minute sulcata glabra; petiolus glaber. Flores ternati unifasciculati terminales in ramulis lateralibus; pedicellus reflexus glaber; bractea basali petaloidea; bracteolae 2 medianae bracteae similes. Calyx quadripartitus segmentis ovatis ad lanceolatis glabris. Corolla quadrilobata urceolata glabra alba, lobis subpatentibus colliculatis. Stamina 8, libera manifesta; filamenta ad basim parum lata recta glabra; antherae obcuneatae glabrae appendiculatae, calcaribus ad apice filamenti decurrentibus pendulis anguste ellipticis ad anguste ovatis fimbriolato-ciliatis; pollen in tetradis. Ovarium quadriloculare late elliptico-turbinatum 4-lobatum vel parum 8-lobatum emarginatum glabrum nectariis basalibus; ovuli ca. 10 in quoque loculo; placenta in dimidio superiore; stylum exsertum glabrum; stigma capitellatum. Fructus non visus.

Compact erect shrub to 400 mm tall, single-stemmed. *Branches*: few erect main branches mostly with continuous vegetative growth and few flowering lateral branches ca. 3–5 mm long, the lower occasionally up to 20 mm, internodes 1–2 mm long, with slight infrafoliar ridges, glabrous or occasionally with a few minute hairs in between the ridges. *Leaves* 3-nate, imbricate, 5–6 × 1 mm, erect to very slightly spreading, narrowly oblong, apex cuspidate, adaxially flattened, abaxially rounded, glabrous, edges minutely ciliate, sulcus narrow; petiole 1 mm long, glabrous, appressed. *Inflorescence:* flowers 3-nate in 1 whorl, terminal on side branches, occasionally on main branches; *pedicel* 6 mm long, reflexed, glabrous, reddish; *bract* partially recaulescent in basal position, 3.5 × 1.0 mm, lanceolate, sulcus ⅓ of its length, glabrous with a few small basal glands, petaloid white tinged pale green and pink toward apex; *bracteoles* 2, like bract but in middle position. *Calyx* 4-partite, ca. ⅔ as long as corolla, segments imbricate at base only, 3.6 ×

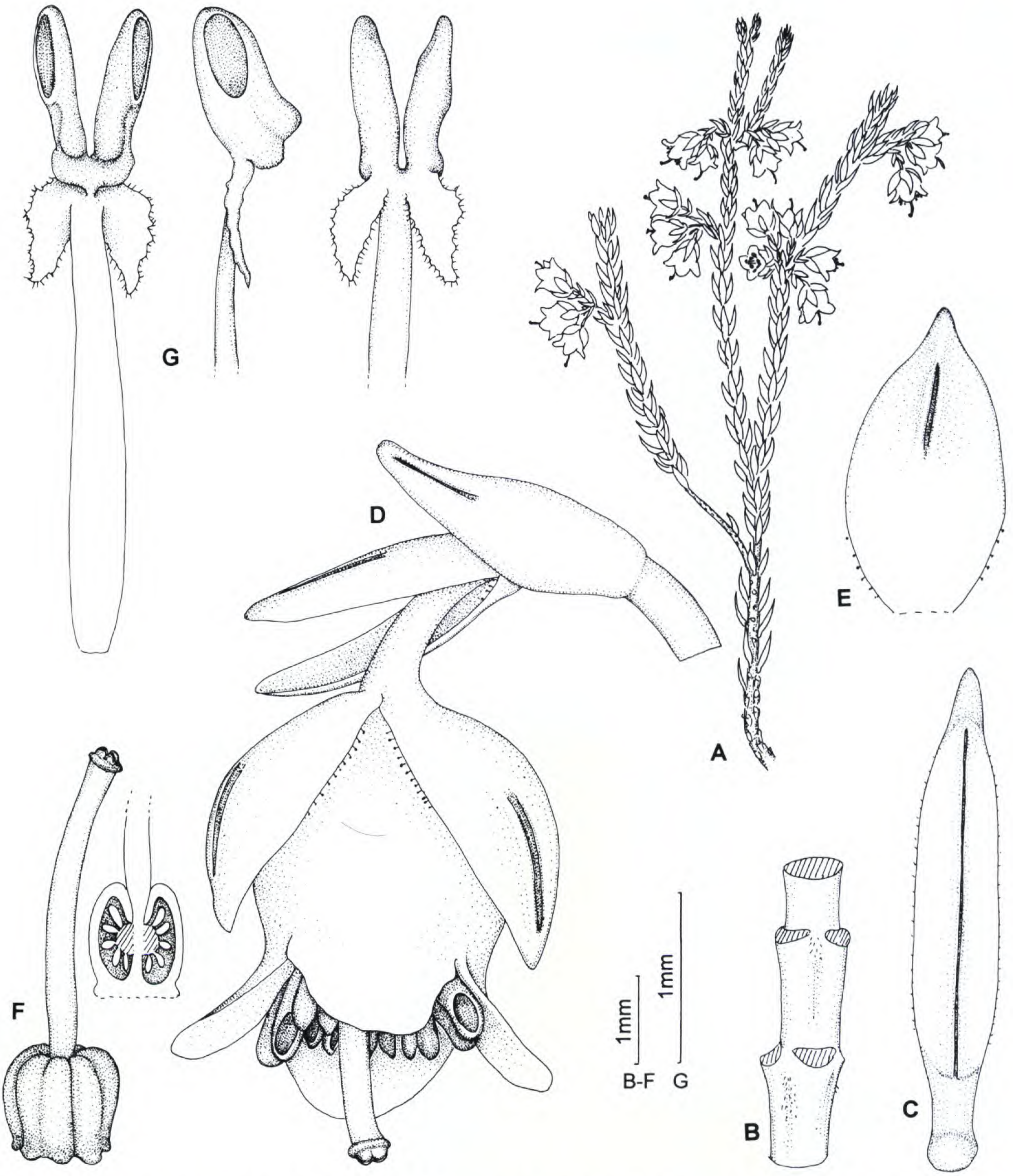


Figure 4. *Erica navigatoris* E. G. H. Oliver. —A. Flowering branch, natural size. —B. Stem. —C. Leaf. —D. Flower. —E. Sepal. —F. Gynoecium with, upper right, ovary cut in half longitudinally. —G. Stamen, front, side, and back views. All drawn from the type collection, *Esterhuysen 29875* (del. Inge Oliver).

1.8 mm, ovate to lanceolate, apex pointed, sulcus narrow, ⅓–½ the length of segment, petaloid white or pinkish, glabrous, margins entire with a few basal slightly stalked minute glands. *Corolla* 4-lobed, 5 × 4 mm, urceolate, glabrous, white and slightly translucent; lobes 1.8 mm long, subspreading, subacute to rounded, colliculate ad- and abaxially, edges very slightly and shortly aculeate. *Stamens* 8, free, manifest; filament 5.5 × 0.6 mm, oblong, slightly broadened toward the base, straight, glabrous; anthers 1 mm long, obcuneate, subbipartite, slightly recurved, glabrous, dark brown, appendiculate; thecae slightly spreading, 1.0 × 0.4 mm, oblong-elliptic, slightly falcate; spurs attached just below thecae on apex of filament, pendulous, ca. 0.7 mm long, narrowly elliptic to narrowly ovate,

white, fimbriolate-ciliolate; pollen in tetrads. *Ovary* 4-locular, 1.2 × 1.2 mm, broadly elliptic-turbinate, 4-lobed or slightly 8-lobed, emarginate, glabrous, shiny, red, somewhat darker at base with small nectaries around base; ovules ca. 10 per locule, erect to spreading to pendulous from a placenta in upper half; style exserted just longer than corolla, straight or slightly curved at apex, glabrous; stigma capitellate. *Fruit* not seen.

This new species is allied to the *Erica brevicaulis* Guthrie & Bolus/*E. costatisepala* H. A. Baker complex in section *Eurystoma*, but can be distinguished by the broadened sclerified spine at the ends of the leaves and sepals (not just acute/pointed), plant glabrous except for a few nonsticky sessile glands on the margins of the sepals (not with hairy anthers, spurs, and ovary), and deeply emarginate ovary (not just slightly so). The flowers of the new species are much larger, about twice the size of the other two species. All have spurs half-decurrent along the apex of the filament, but in *E. navigatoris* and *E. costatisepala* these spurs are broad and flattened and in *E. brevicaulis* narrow.

Erica navigatoris is known from only two localities some 60 km apart in the central inland mountains of the Western Cape (Fig. 2). Most of the collections were made on middle slopes of the Matroosberg, which is the highest mountain in the region at 2250 m (matroos = sailor, hence the specific epithet). *Erica brevicaulis* is also known only from the Hex River mountains, including Matroosberg, but from the summits and forming very small, compact, woody shrublets. *Erica costatisepala* occurs on the ranges to the east of the above localities, mainly on the Klein Swartberg, where it forms low, semispreading shrublets against rock faces at high altitudes.

Paratypes. SOUTH AFRICA. **Western Cape:** 3319: (–BC), Worcester District, Matroosberg, SE slopes, rocky, 5000 ft. (1525 m), 13 Nov. 1960, *Esterhuysen 28627* (BOL); Matroosberg, *Marloth s.n.* (NBG); De Doorns, mountains near Groot Kloof, Jan. 1948, *Stokoe sub SAM 62329* (BOL, SAM). 3320: (–CB), Montagu District, Waboomsberg, rock outcrops up to summit, 3950 ft. (1205 m), 12 Nov. 1989, *Bean, Viviers & Vlok 2091* (BOL, NBG).

Literature Cited

Gunn, M. & L. E. Codd. 1981. Botanical Exploration of Southern Africa. Balkema, Cape Town.

Novedades en *Thelypteris* subg. *Amauropelta* (Thelypteridaceae) de Brasil y Paraguay

M. Mónica Ponce
Instituto de Botánica Darwinion, C. C. 22, 1642 San Isidro, Argentina

RESUMEN. Se dan a conocer nuevas combinaciones en *Thelypteris* subg. *Amauropelta*: *T. eriosora*, *T. novaeana*, *T. rioverdensis* y *T. tamandarei* de Brasil. Se cita por primera vez *T. oligocarpa* var. *crassistipitata* para Brasil y se dan nuevas localidades brasileñas de *T. glaziovii* y *T. heineri*. Se establecen nuevos sinónimos para *T. mosenii* de Brasil y Paraguay.

ABSTRACT. New combinations are proposed in *Thelypteris* subg. *Amauropelta*: *T. eriosora*, *T. novaeana*, *T. rioverdensis*, and *T. tamandarei* from Brazil. New records of *T. oligocarpa* var. *crassistipitata* from Brazil and a new Brazilian range of *T. glaziovii* and *T. heineri* are provided. New synonymies for *T. mosenii* from Brazil and Paraguay are also established.

Para la región centro-E de Sudamérica, sin contar Bolivia, se conocen actualmente alrededor de 40 especies de *Thelypteris* subg. *Amauropelta*. Como parte del estudio de estos helechos, recientemente se publicó una revisión para Brasil austral que comprende 20 especies (Ponce, 1995), y a continuación se dan a conocer novedades nomenclaturales y de distribución, previos al tratamiento global del subg. *Amauropelta* en Brasil y Paraguay.

COMBINACIONES NUEVAS

Thelypteris eriosora (Fée) Ponce, comb. nov. Basónimo: *Aspidium eriosorum* Fée, Crypt. Vasc. Brés. II: 73, t. 101. 1873. *Dryopteris eriosora* (Fée) C. Christensen, Ind. fil. 263. 1906. SINTIPOS: Brasil. Rio de Janeiro: *Glaziou 5264, 5265* (no localizados).

Dryopteris janeirensis Rosenstock, Hedwigia 56: 367. 1915. *Lastrea janeirensis* (Rosenstock) Brade, Bradea 1(22): 222. 1972. TIPO: Brasil. Rio de Janeiro: Serra do Itatiaia, 2250 m, 4–10 June 1913, *F. Tamandaré & A. C. Brade 6462* (holótipo, HB; isótipo UC).

Ilustración. Figura 1A–C.

Distribución. En los altos del cordón montañoso de Mantiqueira en los Estados de Rio de Janeiro y São Paulo.

Observación 1. Aunque no pudieron localizarse los sintipos de *Aspidium eriosorum* Fée, su descripción original está ilustrada por un aspecto general y detalles de la planta que son idénticos al material tipo y adicional estudiados de *D. janeirensis* Rosenstock. Sobre la base de esta evidencia y de que ambos taxones provienen de la misma región de Rio de Janeiro, la Sierra de Itatiaia, se los considera sinónimos, teniendo prioridad el binomio de Fée.

Observación 2. Christensen (1907) mencionaba a *Dryopteris scariosa* Rosenstock como muy similar a *A. eriosorum* por el aspecto de la planta y forma de las pinnas. Sin embargo esta última es una especie de mucho mayor porte, presentando casi el doble de tamaño y las pinnas basales abrupta y extremadamente reducidas, siendo el pecíolo la mitad o la tercera parte de la fronde; asímismo el indumento de la lámina es diferente. *Dryopteris scariosa* se acerca mucho más a *T. sanctae-catharinae* (Rosenstock) Ponce, coincidiendo notablemente en el tipo y distribución del indumento foliar, en el tamaño y en la forma del rizoma y de la frondes, por lo que se incluyó en la sinonimia de esa especie (Ponce, 1995).

Ejemplares estudiados. BRASIL. **Rio de Janeiro:** Sierra de Itatiaia, Macieiras, 2000 m, 21 June 1930, *Brade 10114* (R); Petrópolis, 1857?, *Glaziou s.n.* (R). **São Paulo:** Campos do Jordão, May 1950, *Leite 3592* (HBR).

Thelypteris novaeana (Brade) Ponce, comb. nov. Basónimo: *Dryopteris novaeana* Brade, Arq. Inst. Biol. Veg. Rio 3: 2, t. 2. 1936. *Lastrea novaeana* (Brade) Brade, Bradea 1(22): 223. 1972. TIPO: Brasil. Ilha Trinidade, 14 Jan. 1917, *P. Campos Porto 575* (holótipo, RB). Figura 1H–J.

Observación. De esta especie sólo se conoce la colección tipo. Es cercana a *Thelypteris cheilanthoides* (Kunze) Proctor. Se diferencia de esta especie por el tamaño sensiblemente menor de la planta en todas sus dimensiones; la presencia de escamas a lo largo de todo el pecíolo y, en menor densidad, del raquis; las pinnas proximales menores, no glanduliformes, de 8–12 mm long., y la

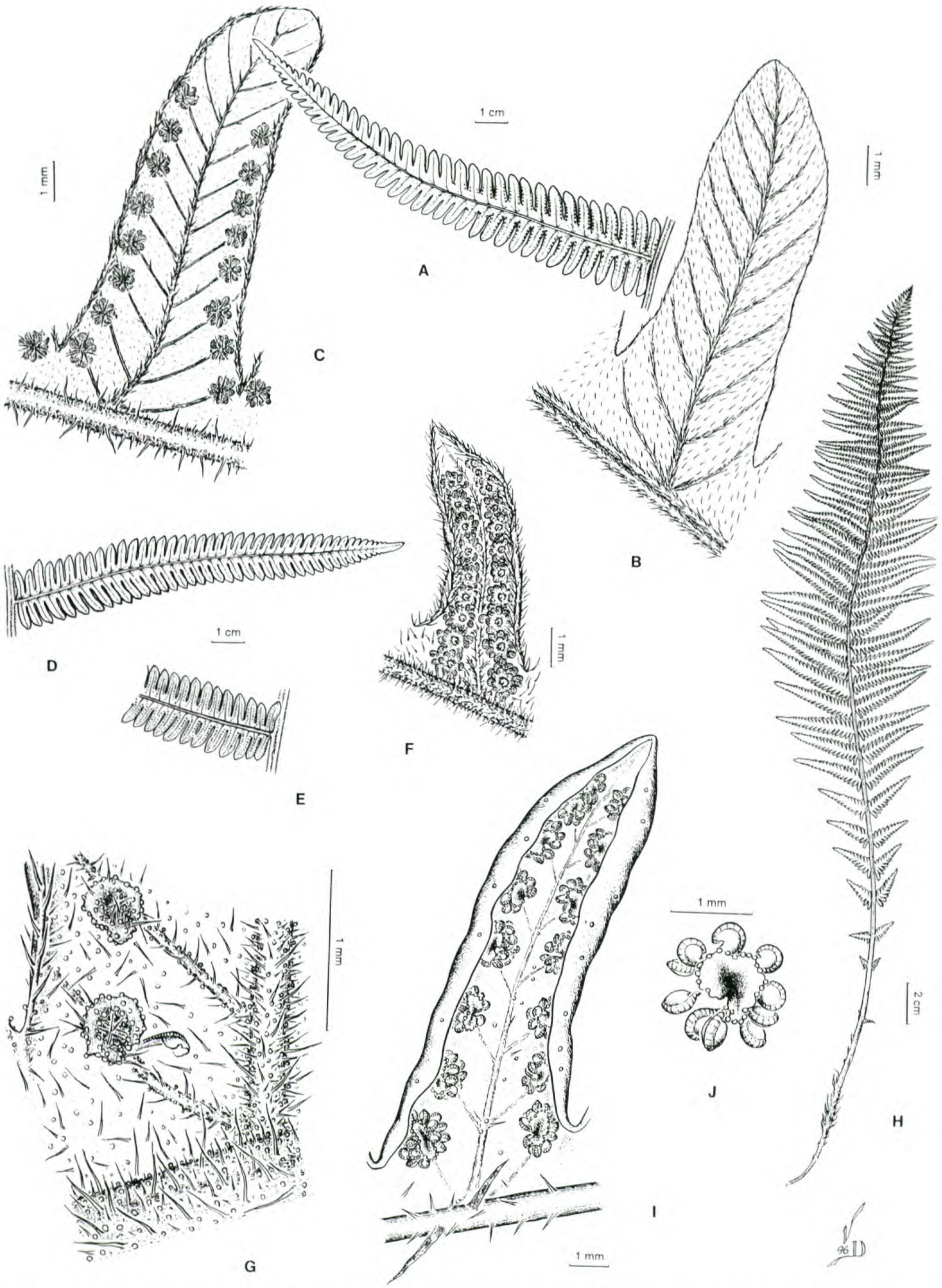


Figura 1. A–C. *Thelypteris eriosora* (Fée) Ponce, *Tamandaré & Brade 6462* (HB). —A. Pinna media. —B. Cara adaxial de un segmento. —C. Cara abaxial de un segmento. D–G. *T. mosenii* (C. Christensen) C. F. Reed, *Hassler 9056 a* (G). —D. Pinna media. —E. Parte de pinna proximal. —F. Cara abaxial de un segmento. —G. Indumento en la cara abaxial de segmento fértil. H–J. *T. novaeana* (Brade) Ponce, *Campos Porto 575* (RB). —H. Aspecto general de una fronde. —I. Cara abaxial de un segmento. —J. Detalle de un soro.

presencia de aeróforos menos desarrollados y mameliformes.

Thelypteris rioverdensis (C. Christensen) Ponce, comb. nov. Basónimo: *Dryopteris rioverdensis* C. Christensen, Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 7, 4: 284, f. 12. 1907. *Lastrea rioverdensis* (C. Christensen) Brade, Bradea 1(22): 223. 1972. TIPO: Brasil. Minas Gerais: Caldas, "In ripa ammis Rio Verde ad rupes umbrosas," 15 Oct. 1873, *Mosén 2171* (holótipo, S). Figura 2A–C.

Observación. Esta especie de Brasil central se hallaría también en Bolivia, aunque esta cita debe corroborarse con más material, ya que el estudiado es estéril. El ejemplar *Hertel 814* de Brasil presenta indusios pilosos, siendo glandulosos en el tipo de *T. rioverdensis.*

Ejemplares estudiados. BRASIL. **Espírito Santo:** Santa Teresa, Estação Ecológica de Santa Lucia, 24 Jan. 1996, *A. Salino 2598* (SI). **Minas Gerais:** Niva Lima, bacia do córrego do Capitão do Mato, 24 Nov. 1995, *A. Salino 2235* (SI). **Paraná:** Caiobá, Morro Taguá, 26 June 1944, *R. Hertel 814* (PKDC). BOLIVIA. **La Paz:** Prov. Noryungas, 12.8 km from Yolosa to Chuspipata, 1800 m, 27 June 1989, *A. Fay & L. Fay 2220* (SJRP).

Thelypteris tamandarei (Rosenstock) Ponce, comb. nov. Basónimo: *Dryopteris tamandarei* Rosenstock, Hedwigia 56: 365. 1915. TIPO: Brasil. São Paulo: Serra do Cantareira, 1000 m, June 1913, *F. Tamandaré & A. C. Brade 6534* (holótipo, HB; isótipo, SP). Figura 2D–F.

Distribución y hábitat. Este helecho robusto y a la vez de textura delicada, crece en la selva nublada, en la cordillera de la costa atlántica en Brasil. Es una especie muy cercana a *T. nubicola* de la Sota de la región de las Yungas en Argentina.

Extensiones de Areas, Nuevos Sinónimos y Cita Nueva

Thelypteris glaziovii (H. Christ) C. F. Reed, Phytologia 17: 279. 1969.

Ilustraciónes. Christensen (1907: 319); Brade (1972: 256).

Distribución. Esta especie que se citaba para el centro-este de Brasil, se encuentra también en el S de ese país.

Ejemplares estudiados. BRASIL. **Rio de Janeiro:** Itatiaia, 2000 m, 1913, *Brade 6552* (UC). **São Paulo:** Sierra de Itapetinga, 26 June 1914, *Brade 7597* (UC). **Santa Catarina:** Lages, *Spannagel 45a* (HBR). **Rio Grande do Sul:** Br. 153, Certão e Passo Fundo, 13 Mar. 1991, *Oliveira 53b* (SJRP).

Thelypteris heineri (C. Christensen) C. F. Reed, Phytologia 17: 282. 1969. Figura 2G–I.

Distribución. Esta especie, cuyos anteriores registros la citan para los estados de Minas Gerais y São Paulo, se ha hallado al oeste en Goiás.

Observación. Pertenece al grupo de *Thelypteris rudis* (Kunze) Proctor, del que se diferencia entre otros caracteres porque tiene esporangios setosos; posteriores estudios permitirán conocer su correcta delimitación.

Ejemplares estudiados. BRASIL. **Goiás:** ca. 12 km Sa. do Ciapó, 840 m, gallery forest, 2 May 1973, *Anderson 9639 a & b* (UC); Itajá-Provoado da Lagoa Santa, Córrego Coqueiro, dentro da mata ciliar, 21 Dec. 1992, *Rodríguez & Silva 406* (SJRP), *664* (SJRP).

Thelypteris mosenii (C. Christensen) C. F. Reed, Phytologia 17: 294. 1968. *Dryopteris mosenii* C. Christensen, Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 7, 4: 300, f. 27. 1907. *Lastrea mosenii* (C. Christensen) Copeland, Gen. fil. 139. 1947. TIPO: Brasil. Minas Gerais: rio Capivary, *Mosén 2161* (holótipo, S).

Dryopteris hassleri H. Christ, Bull. Herb. Boissier, (sér. 2) 7: 922. 1907. Syn. nov. TIPO: Paraguay. Caaguazú: *Hassler 9056 a* (holótipo, G).

Dryopteris rojasii H. Christ, Repert. Spec. Nov. Regni Veg. 6: 349. 1909. Syn. nov. TIPO: Paraguay. Amambay: Sierra de Amambay, pr. Estrella, *Rojas s.n.* (*Hassler 10154 a*) (holótipo, G).

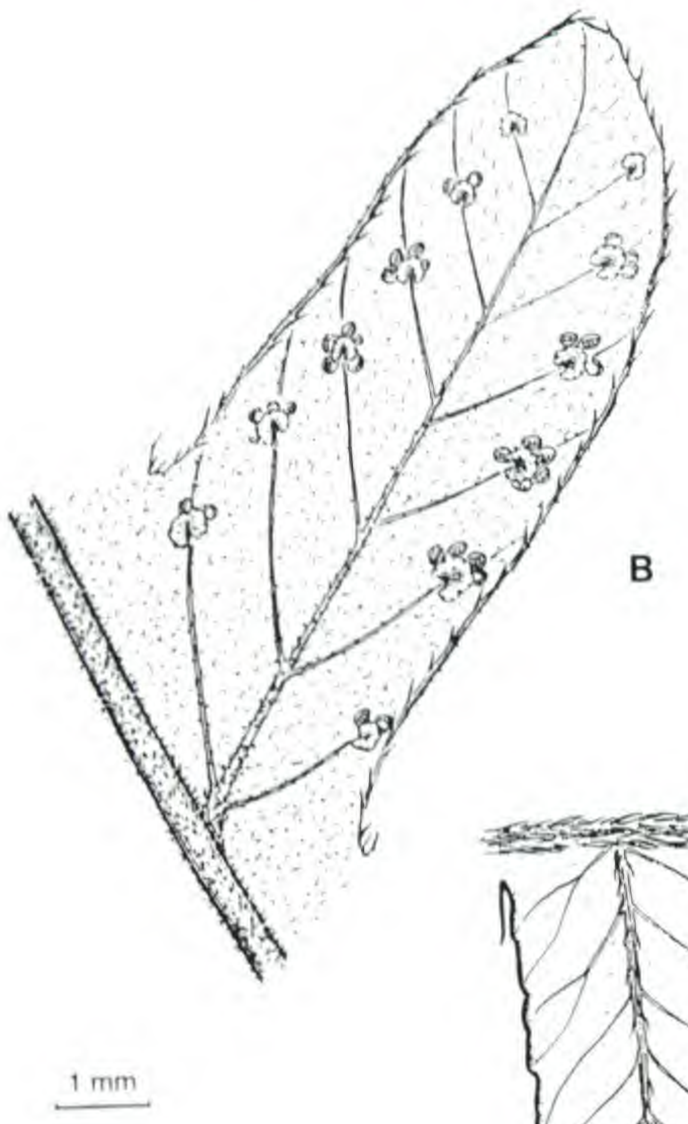
Ilustración. Figura 1D–G.

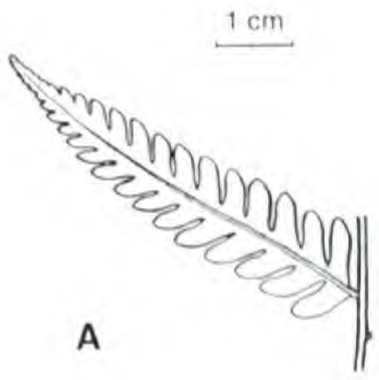
Distribución y hábitat. Especie del centro-E y S de Brasil y E de Paraguay. Crece en selvas en galería, cerrados y pastizales, en suelos pantanosos.

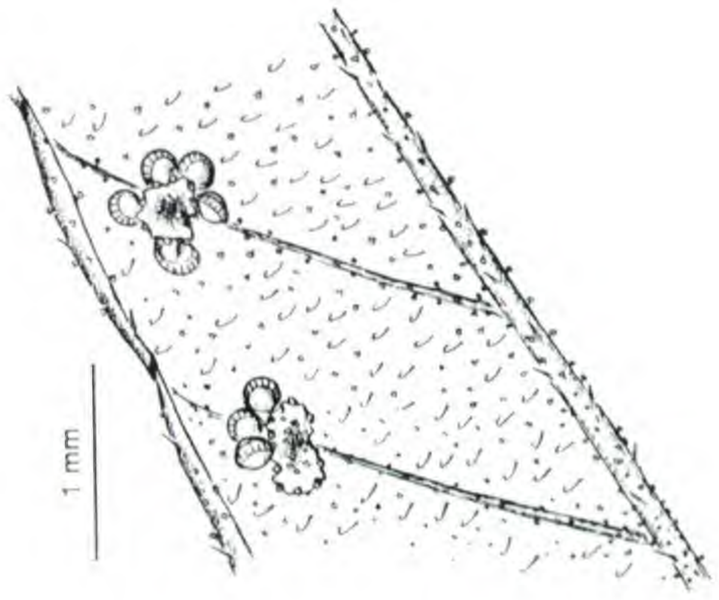
Observación. Dryopteris mosenii C. Christensen y *D. hassleri* H. Christ fueron publicados en el mismo año. La especie de Christ se publicó el 31 de octubre de 1907; pero no se pudo precisar la fecha exacta de publicación del trabajo de Christensen; por lo tanto se mantiene la combinación *Thelypteris mosenii.*

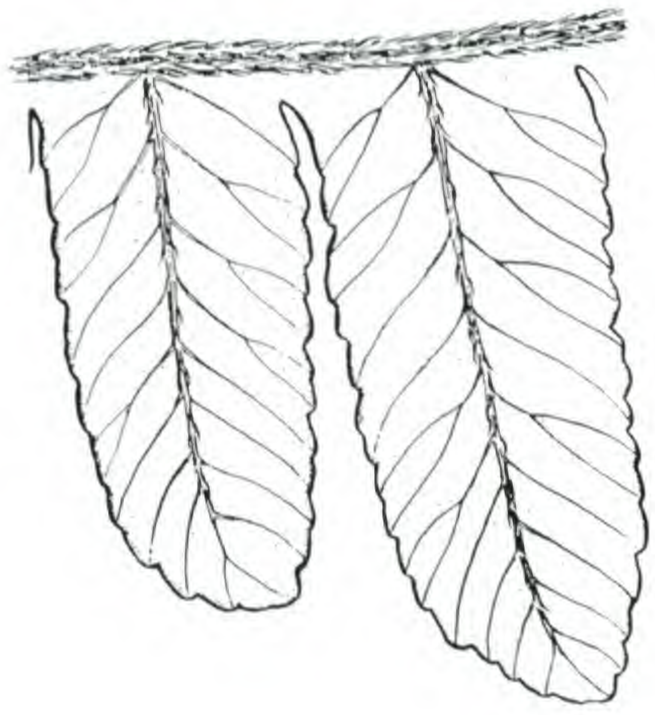
Ejemplares estudiados. BRASIL. **Goiás:** Presidente Kennedy, road from hwy. BR-153 to Itapora, Faz. Primavera along Riberão Teunho, 4 Jan. 1980, *Plowman et al. 8371* (UC). **São Paulo:** São José do Rio Preto, proximo a talhados, umido a margem de riacho, 9 Dec. 1990, *C. A. Silva et al. 1* (SJRP); São Caetano, 15 Nov. 1913, *Brade 6633* (UC). PARAGUAY. **Alto Paraná:** Reserva Biol. Itabó, 35 km W río Paraná, 54°5′W, 25°5′S, en pantano, 10 Oct. 1990, *Schinini & Caballero Mármori 27098* (G).

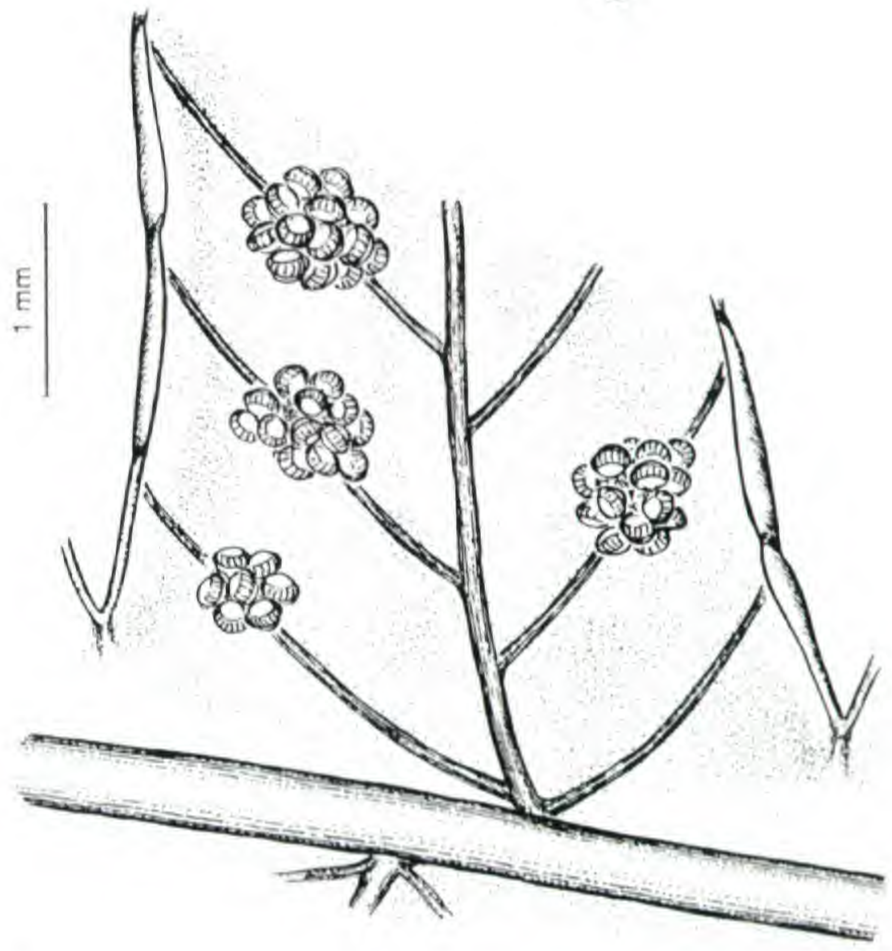
Thelypteris oligocarpa (Humboldt & Bonpland ex Willdenow) Ching var. **crassistipitata** (Hieronymus) C. F. Reed, Phytologia 17: 298. 1969.

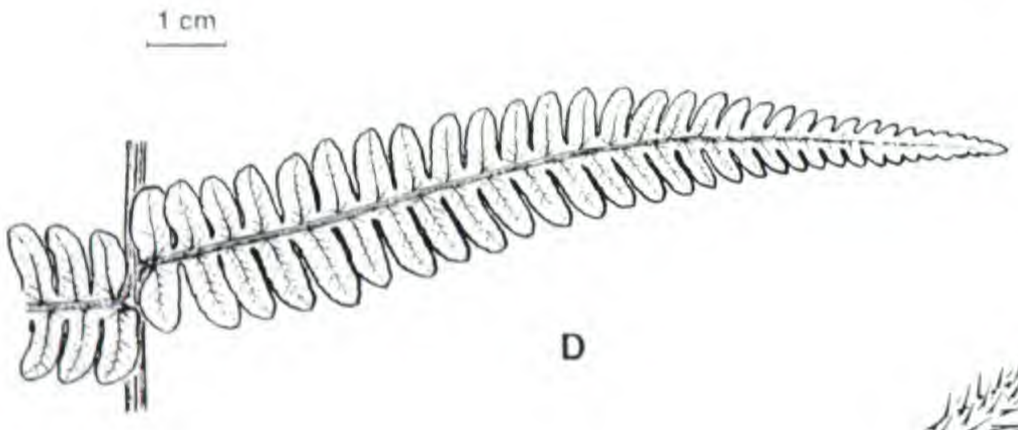


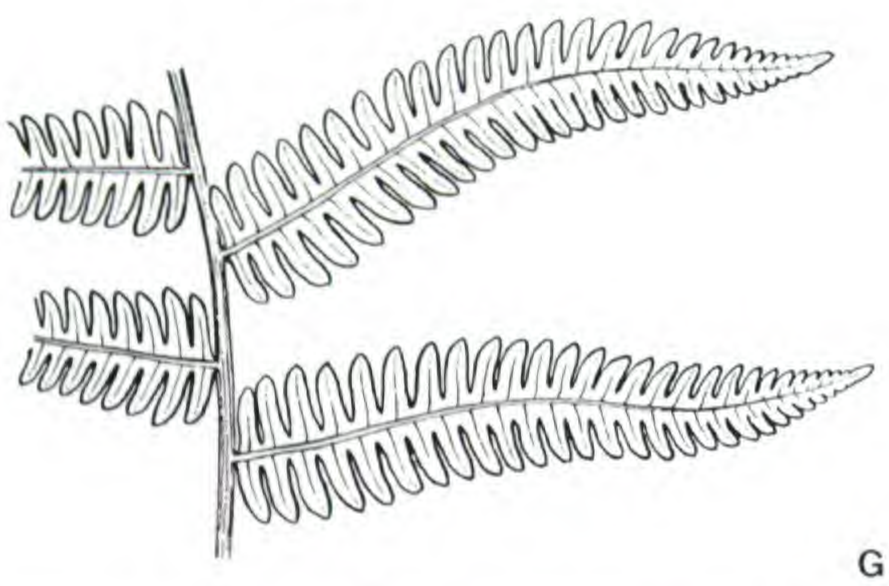












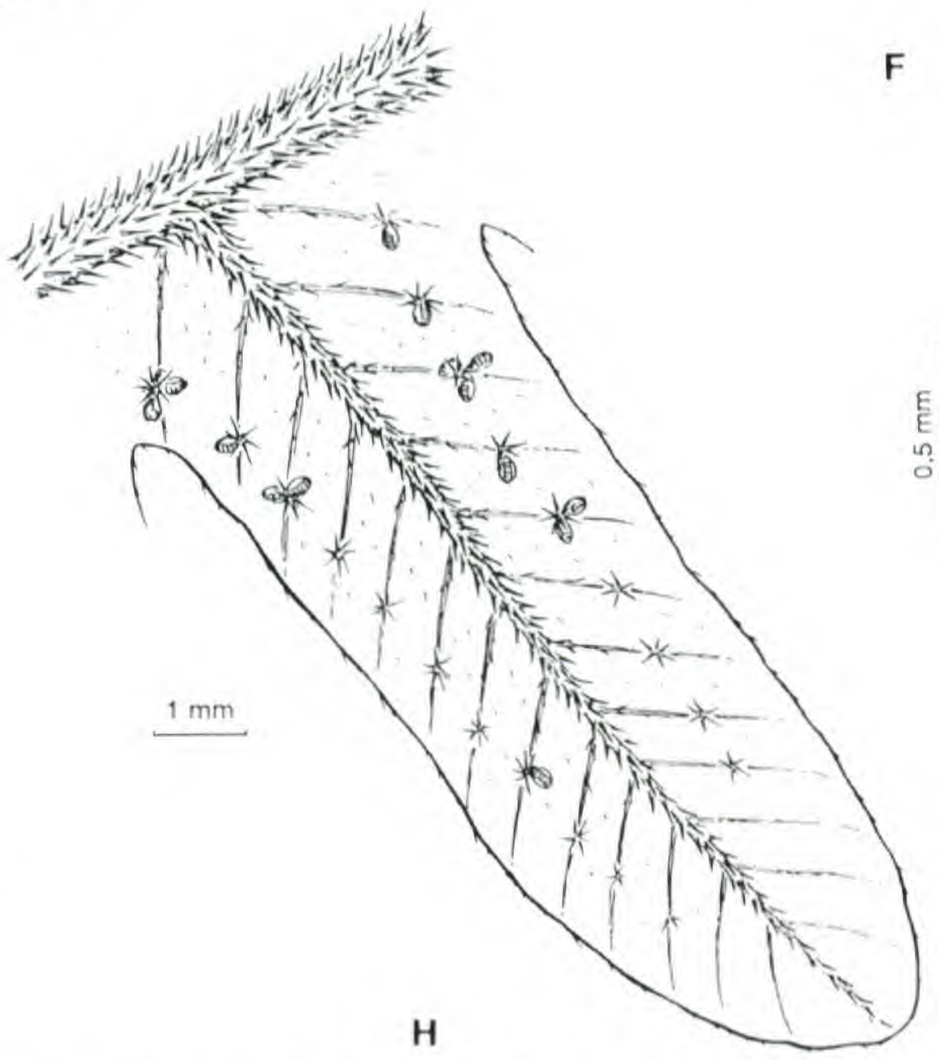


Figura 2. A–C. *Thelypteris rioverdensis* (C. Christensen) Ponce, *Mosén 2171* (S). —A. Pinna media. —B. Cara abaxial de un segmento. —C. Indumento en la cara abaxial de segmento. D–F. *T. tamandarei* (Rosenstock) Ponce, *Tamandaré & Brade 6534* (HB). —D. Pinna media. —E. Segmentos del lado adaxial. —F. Cara abaxial de un segmento fertil. G–I. *T. heineri* (C. Christensen) C. F. Reed, *Heiner 540* (S). —G. Pinnas medias. —H. Cara abaxial de un segmento. —I. Esporangio con pelo en la cápsula.

Ilustraciones. De la Sota (1977: 208); Ponce (1988: 325).

Distribución y hábitat. Esta variedad conocida para las selvas subtropicales del NW de Argentina, se encuentra también en Brasil central, en las selvas y bosques en galería.

Observaciones. Se destacan por su distribución geográfica, *T. oligocarpa* var. *crassistipitata* del cen-

tro-E de Brasil y NW de Argentina y *T. rioverdensis*, del centro-E de Brasil y presumiblemente en Bolivia. En general las especies de *Thelypteris* son higrófilas y heliófilas, por lo que las formaciones ribereñas ("matas ciliares") constituirían estaciones intermedias en la conexión y distribución de especies entre el centro de alta concentración del E de Brasil y las selvas y bosques subtropicales de Bolivia y NW de Argentina.

Ejemplares estudiados. BRASIL. **Goiás:** Aporé, rod. GO-184 Aporé-Serranópolis, Faz. Cachoeira do Corrente, 620 m, margem do ribeirão, próximo da cachoeira, 10 June 1993, *M. R. Silva 870* (SJRP). **Espírito Santo:** Santa Teresa, trilha que sobe a encosta ao lado da entrada do Country Club, 25 Feb. 1996, *A. Salino 2637* (SI).

Agradecimientos. Agradezco a los herbarios G, HB, HBR, PKDC, R, RB, S, SJRP, SP y UC por los préstamos de materiales de estudio, y al personal de las instituciones R, RB, SJRP y SP que tan gentilmente me recibieron durante mi estadía en Brasil. También mi agradecimiento para Vladimiro Dudas por los dibujos que ilustran este trabajo.

Literatura Citada

Brade, A. C. 1972. O gênero *Dryopteris* (Pteridophyta) no Brasil e sua divisão taxonômica. Bradea 1: 191–261.

Christensen, C. 1907. Revision of the American species of *Dryopteris* of the group of *D. opposita*. Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 7, 4: 249–336.

Ponce, M. M. 1988 [1987]. Revisión de las Thelypteridaceae (Pteridophyta) argentinas. Darwiniana 28: 317–390.

———. 1995. Las especies austrobrasileñas de *Thelypteris* subg. *Amauropelta* (Thelypteridaceae, Pteridofita). Darwiniana 33: 257–283.

Sota, E. R. de la 1977. Pteridophyta. *En* A. L. Cabrera (editor), Flora de la Provincia de Jujuy, República Argentina. Colecc. Ci. Inst. Nac. Tecnol. Agropecu. 13(2): 1–275.

Saurauia homotricha (Actinidiaceae), a New Species from Honduras and Nicaragua

Amy Pool

Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Saurauia homotricha*, a new species from montane forests of western Honduras and Nicaragua, is described and illustrated. It is placed in the Central American series *Gymnogynae* Buscalioni and is most similar to *Saurauia rubiformis* Vatke, from which it differs most markedly in the type, length, and distribution of trichomes on the leaves and the abaxial surface of the sepals.

The genus *Saurauia* consists of approximately 300 species from the Neotropics (excluding the Antilles) and tropical Asia. Twenty-five species have been recognized for Mexico and Central America; 22 are treated in Hunter's (1966) revision of the Mexican and Central American species, with 2 more Mexican species described by Keller and Breedlove (1981) and 1 more from Honduras described by Soejarto (1985). An additional species of *Saurauia* from Honduras and Nicaragua was recognized during preparation of a treatment of the Actinidiaceae for the *Flora de Nicaragua* and is here described. The pubescence terminology employed is that described and illustrated in Hunter's revision.

Saurauia homotricha A. Pool, sp. nov. TYPE: Nicaragua. Nueva Segovia: Río Achuapa, al sur del Cerro Mogotón, 1500 m, 12 June 1975 (buds and flowers), *Atwood & Neill 16* (holotype, MO; isotype, HNMN?). Figure 1.

Species nova *Saurauiae rubiformi* Vatke similis, sed ab ea foliis supra inter venulas setulosis trichomatibus 1–1.5 mm longis infra inter venulas hirsutis atque stellato-pilosis, sepalorum partibus in alabastro expositis plumuloso-setulosis trichomatibus 1.75–2 mm longis differt.

Small tree, ca. 5 m tall, the young branches densely covered with shaggy-hirsute to shaggy-setose trichomes; trichomes to 2 mm long, shaggy mainly at base, golden to rusty-brown, mixed with minute, appressed-stellate trichomes. Leaves alternate, aggregated at tips of branches. Petioles 1.5–3.5 cm long, terete, indumentum as on young branches. Leaf blades oblanceolate, 19–28 cm long, 7–11 cm wide, short-acuminate at apex, cuneate to rounded at base, serrulate, with 16–29 pairs of secondary veins; tertiary veins more prominent on abaxial surface than higher order venation; adaxial surface abundantly to sparingly covered with setose trichomes 1–1.5 mm long; abaxial surface abundantly covered with a mixture of hirsute and stellate trichomes with long spreading arms, with primary and secondary veins densely covered by shaggy-setose trichomes. Inflorescence a narrow, axillary thyrse with 9–20 flowers, 3.5–14 cm long, peduncle 1.5–6 cm long, indumentum as on young branches; flowers actinomorphic, 14–18 mm diam.; sepal aestivation quincuncial, sepals elliptic to oblanceolate, 7–9 mm long, 4–4.5 mm wide, obtuse at apex, non-ciliolate, adaxial surfaces densely covered with minute, appressed-stellate trichomes, abaxial surface of outer two sepals densely covered with 1.75–2 mm long, shaggy-setose trichomes throughout, abaxial surface of imbricate sepal with exterior half (half exposed in bud) densely covered with 1.75–2 mm long, shaggy-setose trichomes and interior half densely covered with minute, appressed-stellate trichomes, abaxial surface of two inner sepals medially with dense 1.75–2 mm long, shaggy-setose trichomes and laterally and marginally densely covered with minute, appressed-stellate trichomes; petals 5, connate at base, oblong, 6–7 mm long, 3–5 mm wide, obtuse at apex, white; stamens 20–26, filaments adnate to base of corolla, 1.5–2 mm long, pubescent at base, trichomes filiform, anthers 2–2.5 mm long; ovary globose, glabrous, 5-locular, styles 5, 4–5 mm long. Fruit a berry, globose, 5-sulcate, ca. 5 mm diam., glabrous.

Soejarto (1969) suggested that many species of *Saurauia* have dimorphic flowers: one form functionally staminate with short styles and high pollen fertility and the other form functionally pistillate with long styles and low pollen fertility. A short-styled form of *Saurauia homotricha* is not currently known.

Hunter (1966) recognized four series in *Saurauia* for Mexico and Central America: *Gymnogynae* Buscalioni, *Gynotrichae* Buscalioni, *Oreophilae* Buscalioni, and *Laevigatae* Buscalioni. *Saurauia homotricha* belongs to the series *Gymnogynae*, which (as emended by Hunter) is characterized by leaves

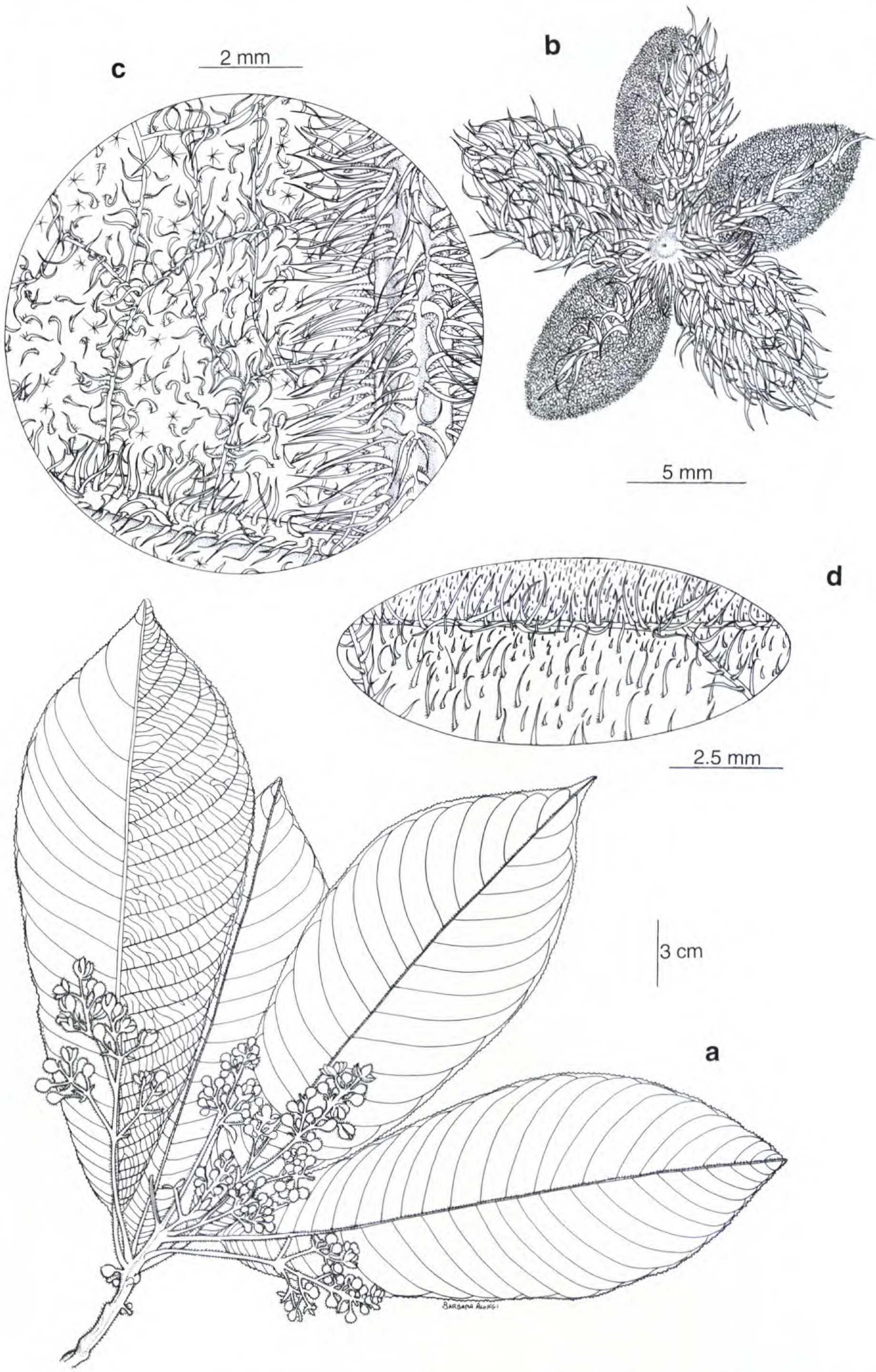


Figure 1. *Saurauia homotricha* A. Pool. —a. Flowering branch. —b. Calyx, abaxial surface. Sepal position starting at 12 o'clock and moving clockwise: imbricate, inner, outer, inner, outer. —c. Leaf, abaxial surface. —d. Leaf, adaxial surface.

with tertiary veins prominent abaxially, sepals densely pubescent and non-ciliolate, and ovaries and fruits glabrous. Within this series, three of the species recognized by Hunter resemble *S. homotricha* in having the adaxial surface of all the sepals completely and densely covered with minute, appressed-stellate trichomes. Hunter's key to these species may be amended to include *S. homotricha* as follows:

1a. Adaxial surface of leaves abundantly sericeous; abaxial surface between veins with dendroid and long-armed stellate trichomes; longer trichomes of sepals shaggy-strigose . . *S. villosa* DC. (Mexico)
1b. Adaxial surface of leaves abundantly to sparsely covered with setose, shaggy-setose or cluster-type trichomes; abaxial surface between veins without dendroid trichomes, the stellate trichomes with medium to very short arms or, if arms longer, then unbranched trichomes also present; longer trichomes of sepals shaggy-setose.
  2a. Adaxial surface of leaf abundantly to sparsely covered with setose trichomes 1–1.5 mm long, surface smooth to touch; abaxial surface between veins abundantly covered with mixture of hirsute and stellate trichomes; abaxial surface of outer sepals homotrichous, trichomes 1.75–2 mm long . . . . *S. homotricha* (Nicaragua and Honduras)
  2b. Adaxial surface of leaf with scattered, shaggy-setose trichomes less than 1 mm long (often only base of hair present), and/or cluster-type trichomes, surface scabrous; abaxial surface between veins with sparse to scattered, stellate to radiate trichomes; abaxial surface of outer sepals heterotrichous with longer trichomes to 1 mm long (often only base of trichomes present) mixed with dense, minute-appressed stellate trichomes.
    3a. Abaxial surface of leaf with sparse, medium-armed stellate trichomes (the longest arms ca. 0.2–0.3 mm long); flowers 9–13 mm diam.; inflorescence usually more than 70-flowered . . *S. pittieri* J. Donnell Smith (Costa Rica and Panama)
    3b. Abaxial surface of leaf with scattered, radiate to short-armed stellate trichomes (the longest arms ca. 0.1 mm long); flowers 15–22 mm diam.; inflorescence usually less than 60-flowered . . . . . *S. rubiformis* Vatke (Guatemala, Honduras, Costa Rica, and Panama)

The South American species of *Saurauia* most similar to *Saurauia homotricha* belong to the series *Macrophyllae* Buscalioni, as emended in Soejarto's revision of the South American species (1980). The two species most similar to *S. homotricha* are *Saurauia herthae* Sleumer and *S. prainiana* Buscalioni. They both differ from *S. homotricha* in having the larger trichomes of the sepals, peduncles, and petioles strigose. In addition, the abaxial leaf surface of *S. herthae* has predominately stellate trichomes, with the unbranched trichomes restricted to the veins. In *S. prainiana*, the area between the veins has a combination of setose and radiate trichomes; in *S. prainiana* var. *prainiana* the trichomes are predominately radiate and in *S. prainiana* var. *pastasana* (Diels) Soejarto, they are predominately setose.

Specimens of *Saurauia homotricha* have been distributed under a variety of names: *Saurauia villosa*, *S. veraguasensis* Seemann, and *S.* cf. *scabrida* Hemsley. *Saurauia homotricha* is distinguished from *S. villosa* in the preceding key. *Saurauia veraguasensis* (= *Saurauia montana* Seemann) is distinguished from *S. homotricha* by its densely pubescent ovary and its sepals with adaxial surfaces submarginally glabrous, the abaxial surface of the two outer sepals heterotrichous with shaggy-strigose trichomes mixed with minute, appressed-stellate trichomes, and the two inner sepals ciliolate. *Saurauia scabrida* is distinguished from *S. homotricha* by its ciliolate sepals, with the adaxial surfaces submarginally glabrous (rarely pubescent for apical half to three-quarters of length) and the abaxial surface of the two outer sepals heterotrichous, with shaggy-strigose to shaggy-setose trichomes less than 1 mm long mixed with minute, appressed-stellate trichomes.

Paratypes. HONDURAS. **Intibucá:** Barranca Yamaranguila, cerca de Yashse, 1500 m, 12 abr. 1956 (buds), *Molina R. 6513* (US). **Comayagua:** in summit forest, cloud zone, range above El Achiote, above plains of Siguatepeque, 1850 m, 1 Aug. 1936 (buds), *Yuncker et al. 6261* (MO). **Morazán:** slopes of Cerro Uyuca (near El Zamorano), ca. 1800 m, 10 Oct. 1975 (buds, flowers, fruit), *Pilz & Pilz 1354-b* (MO).

Acknowledgments. I thank W. D. Stevens, Michael Grayum, and Djaja Soejarto for their advice and encouragement, Roy Gereau for assistance in preparing the Latin description, Barbara Alongi for providing the illustration, and the curators at US and F for specimen loans.

Literature Cited

Hunter, G. E. 1966. Revision of Mexican and Central American *Saurauia* (Dilleniaceae). Ann. Missouri Bot. Gard. 53: 47–89.

Keller, B. T. & D. E. Breedlove. 1981. Two new species of *Saurauia* (Actinidiaceae) from Mexico. Syst. Bot. 6: 65–73.

Soerjarto, D. D. 1969. Aspects of reproduction in *Saurauia*. J. Arnold Arbor. 50: 180–193.

———. 1980. Revision of South American *Saurauia* (Actinidiaceae). Fieldiana, Bot., n.s. 2: i–141.

———. 1985. *Saurauia molinae*, a new species of Actinidiaceae from Central America. Ann. Missouri Bot. Gard. 72: 878–880.

New Species of *Trichocentrum* (Orchidaceae) from the Andes with a Realignment of the *Trichocentrum pulchrum* Group

Franco Pupulin
Research Associate, Marie Selby Botanical Gardens.
Mailing address: Via B. Marcello 93, 20124 Milano, Italy

ABSTRACT. Two new species of *Trichocentrum*, *T. obcordilabium* Pupulin and *T. viridulum* Pupulin, are described from the northwestern South American Andes. *Trichocentrum brandtiae* Kraenzlin and *T. verruciferum* Schlechter are reduced to synonymy of *T. longicalcaratum* Rolfe, and a new key to the *Trichocentrum pulchrum* group is provided.

Trichocentrum Poeppig & Endlicher is a neotropical genus of about 24 epiphytic species distributed from southern Mexico to Brazil, Bolivia, and Peru. Cladistic analysis based on variation in chloroplast DNA (Chase & Palmer, 1992) suggests close relationships within the *Lophiaris* clade, including *Oncidium* sect. *Cebolletae* Lindley and *O.* sect. *Plurituberculata* Lindley, where *Trichocentrum* occupies a derived position.

In a revision of the genus, Pupulin (1995) gathered three Andean species of *Trichocentrum* in an informally proposed "*Trichocentrum pulchrum* group" on the basis of their triquetrous ovaries and the thickened keels from the base of the disk. Recently flowered *Trichocentrum* specimens from Colombia and Ecuador shared the characters of this group, but they proved to be different and hitherto undescribed taxa. Two new *Trichocentrum* species are therefore proposed herein, together with a general realignment of the taxa close to *Trichocentrum pulchrum* Poeppig & Endlicher.

Trichocentrum obcordilabium Pupulin, sp. nov. TYPE: Ecuador. Morona-Santiago: San Juan Bosco (1600 m), Feb. 1993, collected by J. Portilla, flowered in cultivation, 6 July 1996, *F. Pupulin 285* (holotype, SEL; isotypes, MO, QCNE, Herb. Pupulin). Figure 1.

Species *Trichocentro pulchro* Poeppig & Endlicher similis, sed floribus campanulatis, labello obcordato carinis quatuor in basi differt.

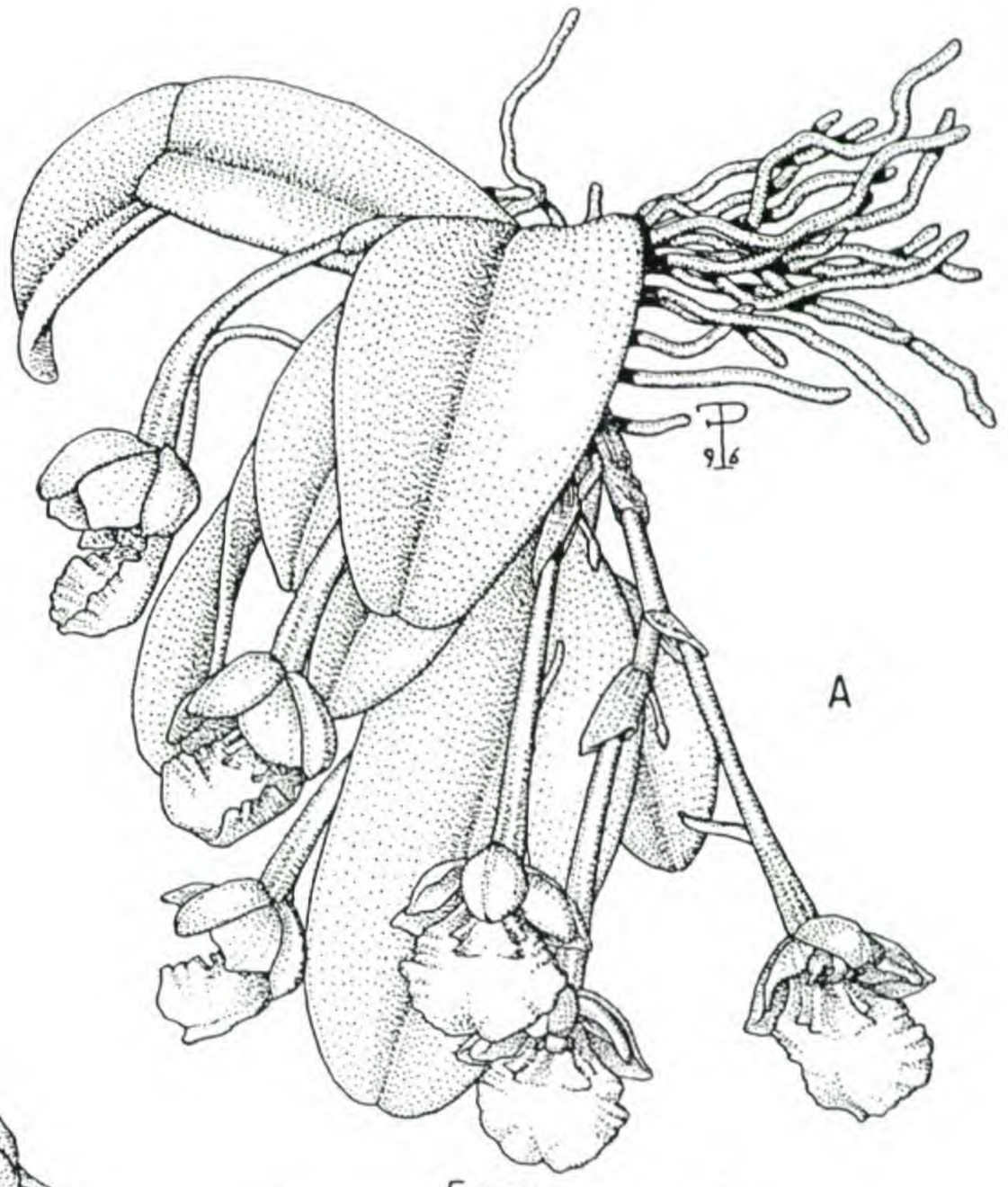
Plant epiphytic, caespitose, pendent, with a short rhizome. Roots flexuous, filiform, produced on the rhizome under the attachment of the pseudobulb. Pseudobulbs nearly obsolescent, ovate, to 6 mm long, about 4.5 mm wide, covered by 2–3 papyraceous sheaths, monophyllous. Leaf fleshy, green, elliptic to elliptic-oblong, sessile, to 8.5 cm long, 3.2 cm wide, retuse. Inflorescence a raceme shorter than leaves, 1- to 2-flowered; peduncle terete, to 2.4 cm long. Floral bracts ovate, acute, to 10.5 mm long, 9 mm wide. Ovary linear-clavate, triquetrous, to about 4 cm long including the pedicel. Flowers campanulate; sepals and petals white, lip yellow with a gold yellow blotch and minute brown spots on the callus. Dorsal sepal widely obovate-elliptic, concave, dorsally carinate, obtuse, obscurely apiculate, 1.25 cm long, 0.9 cm wide. Lateral sepals obliquely elliptic, concave toward the apex, dorsally carinate, obtuse to acute, apiculate, 1.35 cm long, 0.75 cm wide. Petals suborbicular, somewhat concave, rounded, 1.25 cm long, 1 cm wide. Lip adnate to the base of the column, obcordate, deeply emarginate at apex, with slightly undulate margins, 2 cm long, 2.6 cm wide, produced at the base into a slender, flexuous spur, about 3 cm long; callus formed by 4 diverging, flattened, finely pubescent keels, the lateral shorter than the central ones. Column short, stout, about 7 mm long, provided with a pair of short, cuneate, lacerate wings. Anther cap hemiglobose-oblong, densely papillose-hirsute in the apical half. Pollinia 2, pyriform, complanate, on a triangular stipe; viscidium elliptic, brown.

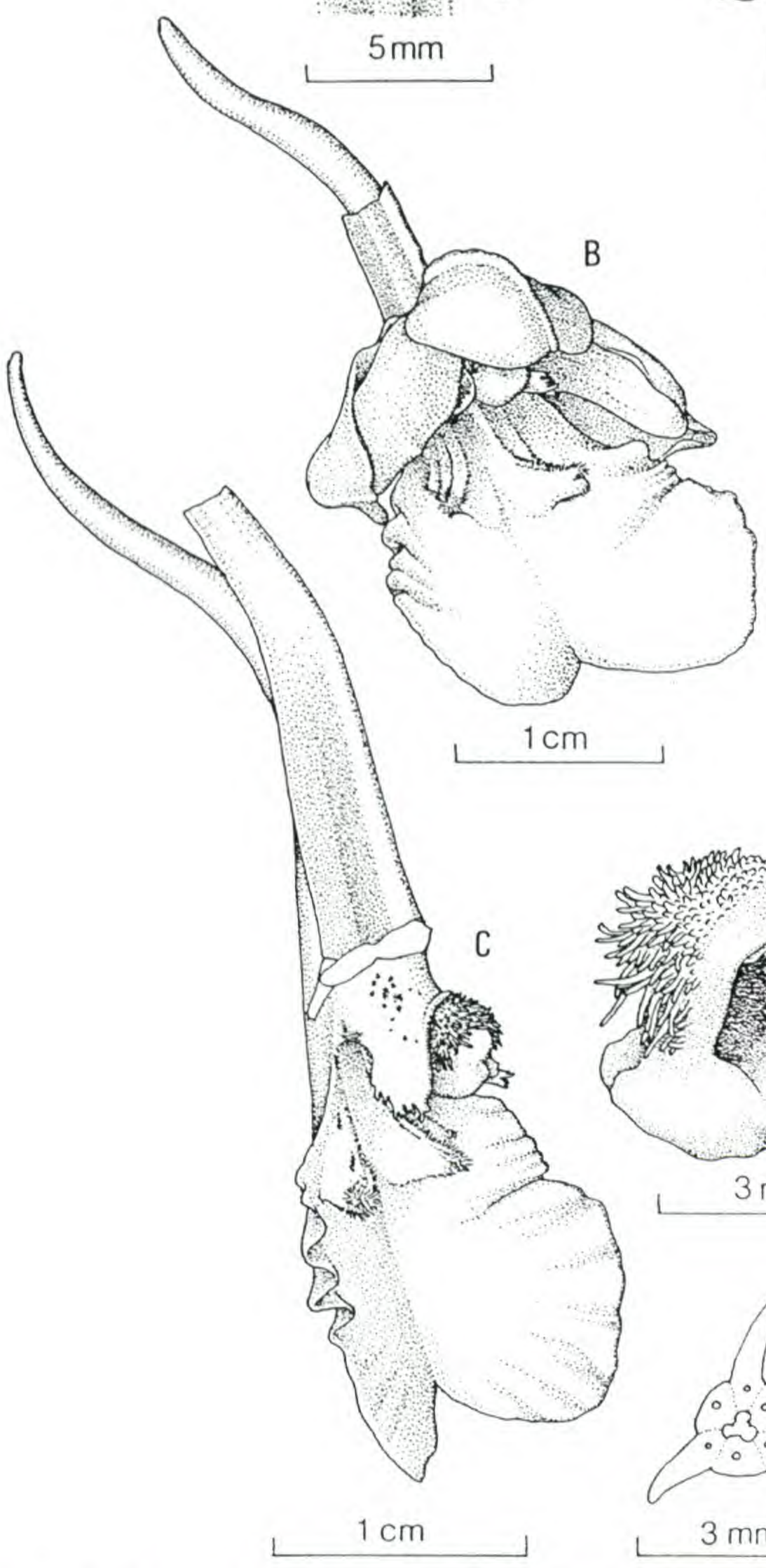
Etymology. From the Latin *obcordatus*, "reversed cordate," referring to the two equal rounded lobes and a deep sinus remote from the attachment, and *labium*, lip, in reference to the reversed heart-shaped labellum.

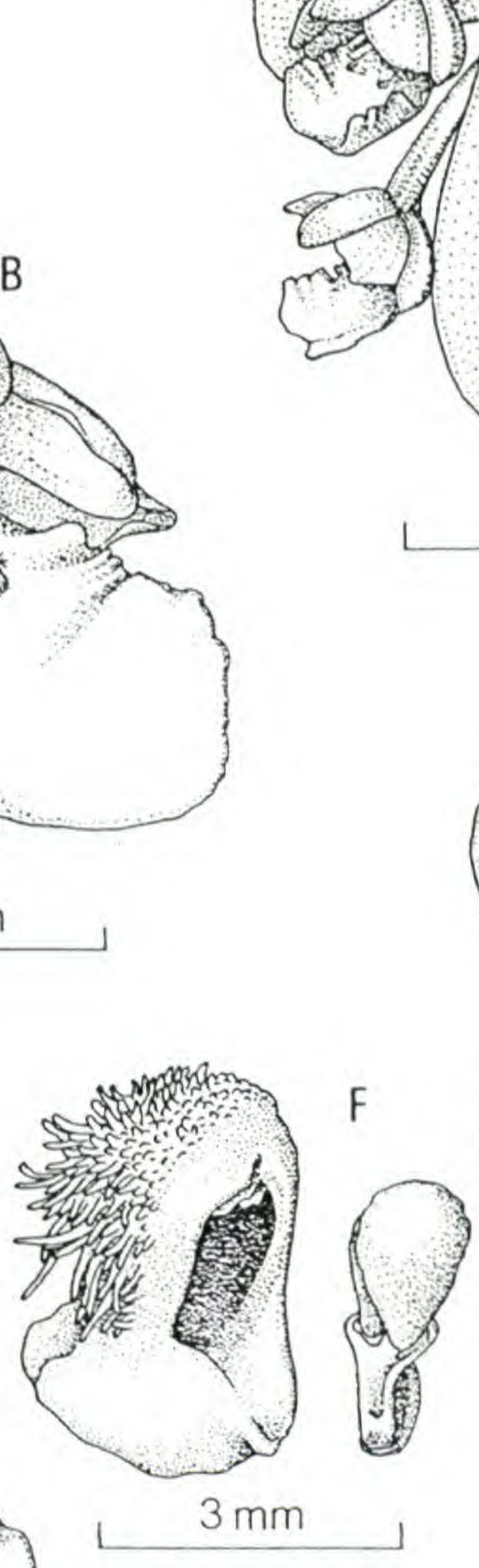
Distribution. Endemic to Ecuador.

Ecology. Epiphytic in submontane rainforests. The eastern basin of the Río Zamora is one of the rainiest areas in Ecuador, with a generally temperate climate (the average temperature is about 21°C) and very high and constant moisture levels (Teran, 1990). Flowering occurs from late July through September.

Trichocentrum obcordilabium is easily distinguished from its close relatives, namely *T. pulchrum*







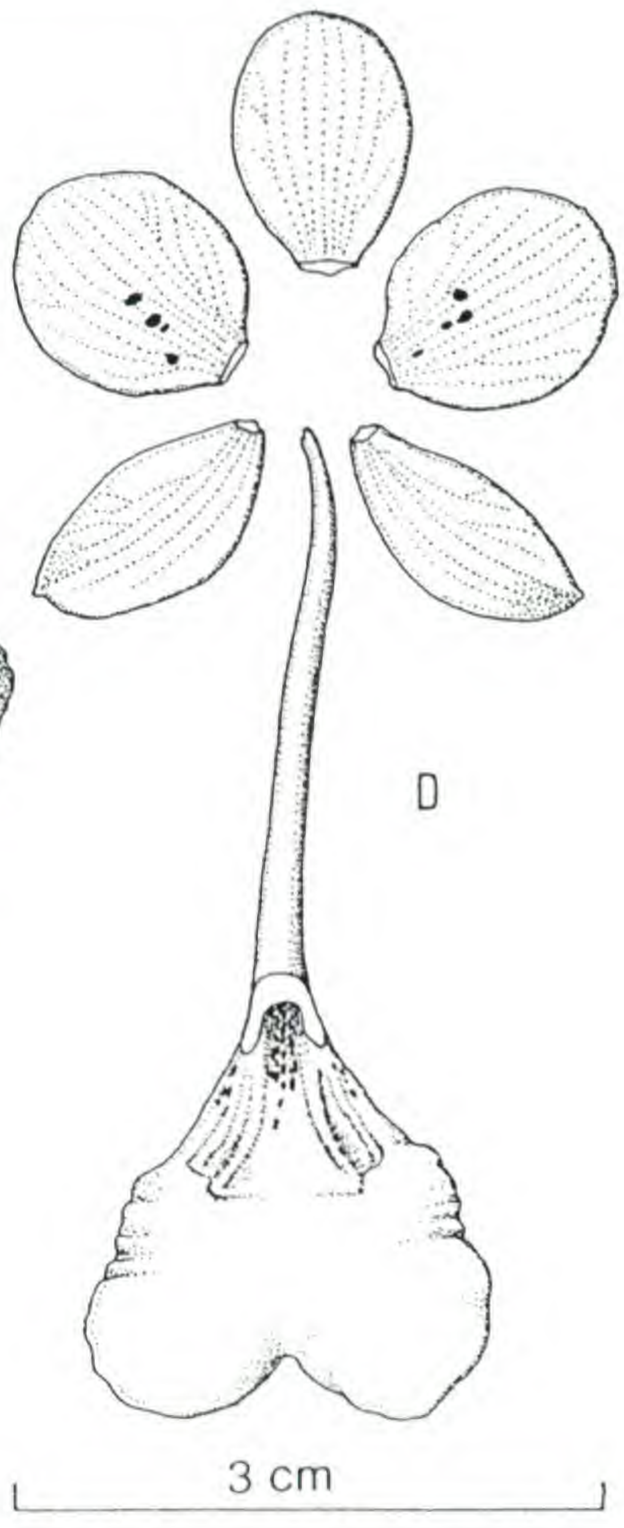


Figure 1. *Trichocentrum obcordilabium* Pupulin (*F. Pupulin 285*). —A. Habit. —B. Flower. —C. Column and lip, with pedicel partially removed. —D. Perianth, flattened. —E. Column, ventral view. —F. Operculum and pollinarium. —G. Ovary, transverse section.

and *T. viridulum*, by the campanulate shape of the flowers, whose segments do not spread out completely, the obcordate lamina of the lip, and the presence of four keels on the disk, a unique character for this group of species.

Paratype. ECUADOR. **Zamora–Chinchipe:** near Zamora, *C. H. Dodson 17828* (RPSC).

Trichocentrum viridulum Pupulin, sp. nov.

TYPE: Colombia. Santander: Charalá, Virolín (1900 m), Mar. 1990, collected by E. Valencia, flowered in cultivation at Colomborquídeas, El Retiro, 24 Aug. 1996, *F. Pupulin 388* (holotype, SEL; isotype, MO). Figure 2.

Species *Trichocentro pulchro* Poeppig & Endlicher similis, sed floribus minoribus omnino inodoribus, concoloribus viridulis, carinis in basi glabris vel obscure puberulis differt.

Plant epiphytic, caespitose, pendent, with a short rhizome. Roots flexuous, filiform. Pseudobulbs small, linear-elliptic, 4.5 mm long, about 3 mm wide, covered at the base by 3 papyraceous sheaths, monophyllous. Leaf fleshy, green, elliptic-ovate to oblong, sessile, 4.8–9.1 cm long, 1.3–2.4 cm wide, obtuse to minutely retuse. Inflorescence a raceme shorter than leaves, bearing a single flower, rarely 2-flowered; peduncle terete, to 2.5 cm long, concealed with a papyraceous, acute bract 9–11 mm long, 5 mm wide. Floral bracts ovate, acute, 9 mm long, 4 mm wide. Ovary linear-clavate, triquetrous, 3 cm long including the pedicel. Flowers spreading; sepals and petals greenish white, lip greenish white with a yellow blotch on the disk toward the entrance of the spur. Dorsal sepal elliptic-obovate, concave, dorsally carinate, obtuse, minutely apiculate, 1.8 cm long, 0.9 cm wide. Lateral sepals obliquely elliptic-oblong, concave, dorsally carinate, acute, 1.9–2 cm long, 0.8 cm wide. Petals obovate-elliptic, acute, 1.6 cm long, 1 cm wide. Lip adnate to the base of the column, widely obovate, emarginate at apex, with slightly undulate margins, 2 cm long, 1.4 cm wide, produced at the base into a slender, flexuous spur, 3.7–4 cm long; callus formed by 2 parallel, flattened, glabrous to obscurely puberulent keels, slightly diverging at apex. Column short, stout, 6 mm long, with a pair of short, dolabriform-subquadrate, erose wings. Anther cap hemiglobose-oblong, carinate, densely papillose-hirsute. Pollinia 2, pyriform, complanate, on a triangular stipe; viscidium peltate, brown.

Etymology. From the Latin *viridulus*, "greenish," alluding to the color of the flower.

Distribution. Endemic to Colombia.

Ecology. *Trichocentrum viridulum* inhabits subandine mesothermic forests along the flanks of the Cordillera Oriental in Colombia. Average temperatures vary from 23° to 16°C, and rainfall may reach 5000 mm a year (Pinto-Escobar, 1993). Flowering occurs in August and September.

Paratypes. COLOMBIA. **Santander:** Charalá, Virolín (1900 m), Mar. 1990, collected by E. Valencia, flowered at Colomborquídeas, El Retiro, 24 Aug. 1996, *F. Pupulin 389* (JAUM) *F. Pupulin 390* (Herb. Pupulin); near Virolín, without further collection data, flowered at Orquifollajes, Medellín, 29 Aug. 1996, *F. Pupulin 392* (photo, Herb. Pupulin).

Trichocentrum viridulum may be distinguished from *T. pulchrum* by the absence of any scent, the smaller size of the flowers, the uniform greenish color of the tepals, and the glabrous keels on the lip. In August 1996 several specimens of this species flowered at Colomborquídeas and Orquifollajes, near Medellín, on which exsiccatae were prepared, and photographs and diagnostic drawings were done. They were later compared with type material of *T. longicalcaratum* at Kew, a species described by R. A. Rolfe in 1896 with a very synthetic protologue. This comparison gave the author the opportunity to revise his concept of *T. longicalcaratum* Rolfe.

In the original description, Rolfe (1896) referred to a specimen flowering in the collection of Sir Trevor Lawrence, and reported the new species as recently named at Kew. At Kew a single flower from "Lehmann, through Mr. J.B. Brien" is annotated by Rolfe himself as "Trichocentrum longicalcaratum, n. sp." Besides the very constricted base of the lip, the flower has an unusually small brownish blotch on the disk. Though the type label does not provide a collection locality, another specimen by Lehmann referable to the same taxon (n. *8379*, AMES) was collected in Colombia at Los Robles, near Anserma Nueva. A second flower annotated by Rolfe as "Trichocentrum longicalcaratum" is kept at Kew. It pertains to the same plant Rolfe had seen in 1896 in the collection of Sir Trevor Lawrence, but it must be undoubtedly referred to the species later described by Kraenzlin as *T. brandtiae.*

Garay (1965) reduced *Trichocentrum brandtiae* Kraenzlin to a synonym of *T. pulchrum*, but later (Garay, 1970) recognized this taxon as a distinct and valid species. This interpretation was followed by Ortiz V. (1991, 1995) and Pupulin (1995). However, Kraenzlin's description was published in 1897, and thus his *T. brandtiae* must be relegated to synonymy of *T. longicalcaratum.* The following taxonomy for the taxon is therefore proposed:

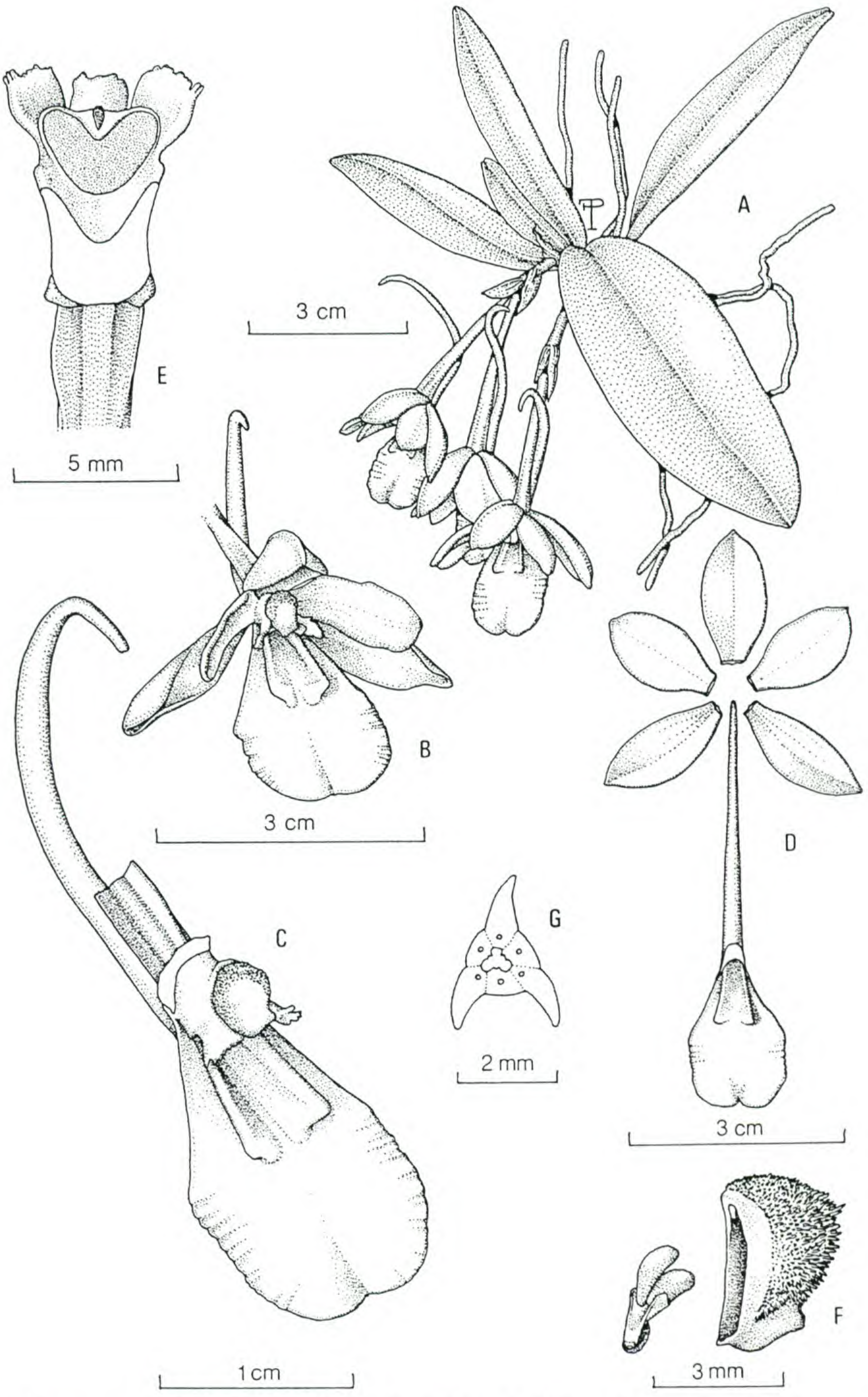


Figure 2. *Trichocentrum viridulum* Pupulin (*F. Pupulin 388*). —A. Habit. —B. Flower. —C. Column and lip, with ovary partially removed. —D. Perianth, flattened. —E. Column, ventral view. —F. Pollinarium and operculum. —G. Ovary, transverse section.

Trichocentrum longicalcaratum Rolfe, Orch. Rev. 4: 260. 1896. TYPE: Colombia. Without locality, *Lehmann s.n. through J. B. Brien* (holotype, K).

Trichocentrum brandtiae Kraenzlin, Bull. Herb. Boiss. 5: 109. 1897. Syn. nov. TYPE: Colombia. Without locality, *Barbey s.n.* (holotype, not located).

Trichocentrum verruciferum Schlechter, Repert. Spec. Nov. Regni Veg. Beih. 7: 184. 1920. Syn. nov. TYPE: Colombia. Cauca: *M. Madero s.n.* (holotype, B destroyed; drawings, Repert. Spec. Nov. Regni Veg. Beih. 57: t. 253. 1929).

In view of the previous findings, a new key to the *Trichocentrum pulchrum* group seems to be necessary:

1a. Spur more than twice as long as the lip . . . . . *T. longicalcaratum*
1b. Spur less than twice as long as the lip.
  2a. Disk of the lip with 4 keels; lip obcordate . . . . . *T. obcordilabium*
  2b. Disk of the lip with 2 keels; lip obovate.
    3a. Keels of the lip papillose; flowers scented; floral segments usually white, marked with purple spots and blotches . . . . . *T. pulchrum*
    3b. Keels of the lip glabrous or obscurely puberulent; flowers unscented; floral segments greenish white, never with purple spots or blotches . . . . *T. viridulum*

Acknowledgments. I am very indebted to Rodrigo Escobar R. for his friendly cooperation in all stages of my work in Colombia. Juan Felipe Posada M. and Francisco Villegas V. opened their collections and shared their plants for this study. I also acknowledge "Pepe" Portilla and Calaway H. Dodson for their precious assistance in Ecuador. A special thanks is due to Jeffrey J. Wood for his continuous courtesy in providing me photographs of the critical material from K.

Literature Cited

Chase, M. W. & J. D. Palmer. 1992. Floral morphology and chromosome number in subtribe Oncidiinae (Orchidaceae): Evolutionary insights from a phylogenetic analysis of chloroplast DNA restriction site variation. Pp. 324–339 *in* Soltis et al. (editors), Molecular Systematics of Plants. Chapman and Hall, New York.

Garay, L. A. 1965. Venezuelan Orchids Illustrated 3: 314. André Deutsch, London.

———. 1970. Orquídeas Colombianas nuevas o criticas. Decena V. Orquideología (Col.) 5: 87–88.

Ortiz V., P. 1991. *Trichocentrum. In* R. Escobar R., Native Colombian Orchids, vol. 4. Editorial Colina, Medellín.

———. 1995. Orquídeas de Colombia. Segunda edición revisada y aumentada. Corporación Capitolina de Orquideología, Santafé de Bogotá.

Pinto-Escobar, P. 1993. Vegetación y flora de Colombia. Fundación Segunda Expedición Botánica—Fondo Nacional Universitario, Santafé de Bogotá.

Pupulin, F. 1995. A revision of the genus *Trichocentrum* (Orchidaceae). Lindleyana 10: 183–210.

Teran, F. 1990. Geografía del Ecuador. Libresa, Quito.

New Combinations in *Malva* (Malvaceae: Malveae)

Martin Forbes Ray
University Herbarium, University of California, Berkeley, California 94720-2465, U.S.A.

ABSTRACT. Four new combinations in *Malva*, *M. assurgentiflora*, *M. lindsayi*, *M. occidentalis*, and *M. wigandii*, and five replacement names, *M. australiana*, *M. canariensis*, *M. dendromorpha*, *M. linnaei*, and *M. pacifica*, are proposed to accommodate species of *Lavatera* that are more closely related to the type species of *Malva* than they are to the type species of *Lavatera*. These species are in the "Malvoid group," discussed by Ray in an earlier paper. One other *Lavatera* species that should also be placed in *Malva* is discussed but not formally transferred. Some lectotypes and neotypes are designated.

Elsewhere (Ray, 1995), I analyzed and discussed the relationships among species of *Malva* L., *Lavatera* L., and six outgroups. I described an analysis of morphological character data that initially appeared to have little value. That analysis was followed by an extensive molecular study and a reinterpretation of morphological characters that brought to light a new way to view these genera and problems associated with them. Ray (1994) and Ray (1995) included extensive discussions of morphological characters and evolutionary trends, generic relationships, relevant literature, chromosome numbers, biogeography, and dispersal issues and should be consulted for a better understanding of the results and conclusions briefly described here.

Based on my analyses of nuclear rDNA "Internal Transcribed Spacer" (ITS) sequence data and morphological characters (Ray, 1994, 1995), I concluded that the species now in *Malva* and *Lavatera* are all closely related in comparison to outgroups in *Alcea*, *Althaea*, *Anisodontea*, *Callirhoë*, and *Hibiscus*. Among *Malva* and *Lavatera* species, at least one well-supported group, consisting of a mixture of species from the two genera, could be defined on the basis of fruit differences and the ITS-based phylogenetic tree. A phylogenetic tree from Ray (1995) showing the results of analysis of ITS is shown in Figure 1. This figure also shows the major species group that can be defined with the additional support of fruit characters, and includes a listing of species that can be assigned to the group on this basis alone. Another more tentative grouping is also shown. Interesting geographic disjunctions in the distribution of species in *Malva* and *Lavatera* are indicated.

Malva L. and *Lavatera* L. have been increasingly problematic since Linnaeus (1753) reinterpreted Tournefort's (1706) generic concept for *Lavatera* and expanded *Lavatera* to cover a much wider range of species than Tournefort intended. Tournefort originally described the genus to segregate *Lavatera trimestris* (a species with relatively unusual characteristics) from *Malva* on the basis of fruit-axis characters. Linnaeus disregarded this and used epicalyx characters to distinguish the two genera. *Lavatera trimestris* L. has an unusual epicalyx that may have led Linnaeus to use this character, but the epicalyx of *L. trimestris* is atypical in comparison to those of nearly all other species traditionally included in *Lavatera* and *Malva*. These genera have long been separated by most workers on the "unsatisfactory" (Fernandes, 1968a) basis of fusion or non-fusion of epicalyx bracts. I found the use of epicalyx characters for the generic distinction to be untenable based on extensive morphological and molecular analyses (Ray, 1994, 1995).

Several species presently in *Lavatera* are closely related to species in *Malva*, in particular to the type species *Malva sylvestris* L. In fact, some species currently included in *Lavatera* are more closely related to *Malva sylvestris* than are some other species traditionally included in *Malva*; they are among the core *Malva* species. My "Malvoid group" (see Fig. 1) includes some *Malva* species plus those species currently included in *Lavatera* that are very closely related to *Malva sylvestris* L. These close relationships among *Lavatera* and *Malva* species are strongly supported by the analyses of ITS data and by fruit characters (Ray, 1995). When the analysis is forced to retain the traditional division between the genera, the trees become significantly longer. Maximum likelihood testing using the forced tree also shows that, given the ITS data, the traditional generic arrangement (based on the epicalyx) is significantly less likely than the tree found.

Species in the Malvoid group (so named because it includes the type species of *Malva*) have true mericarps that: (a) are rounded in only the axial direction on the abaxial side, (b) have lateral angles

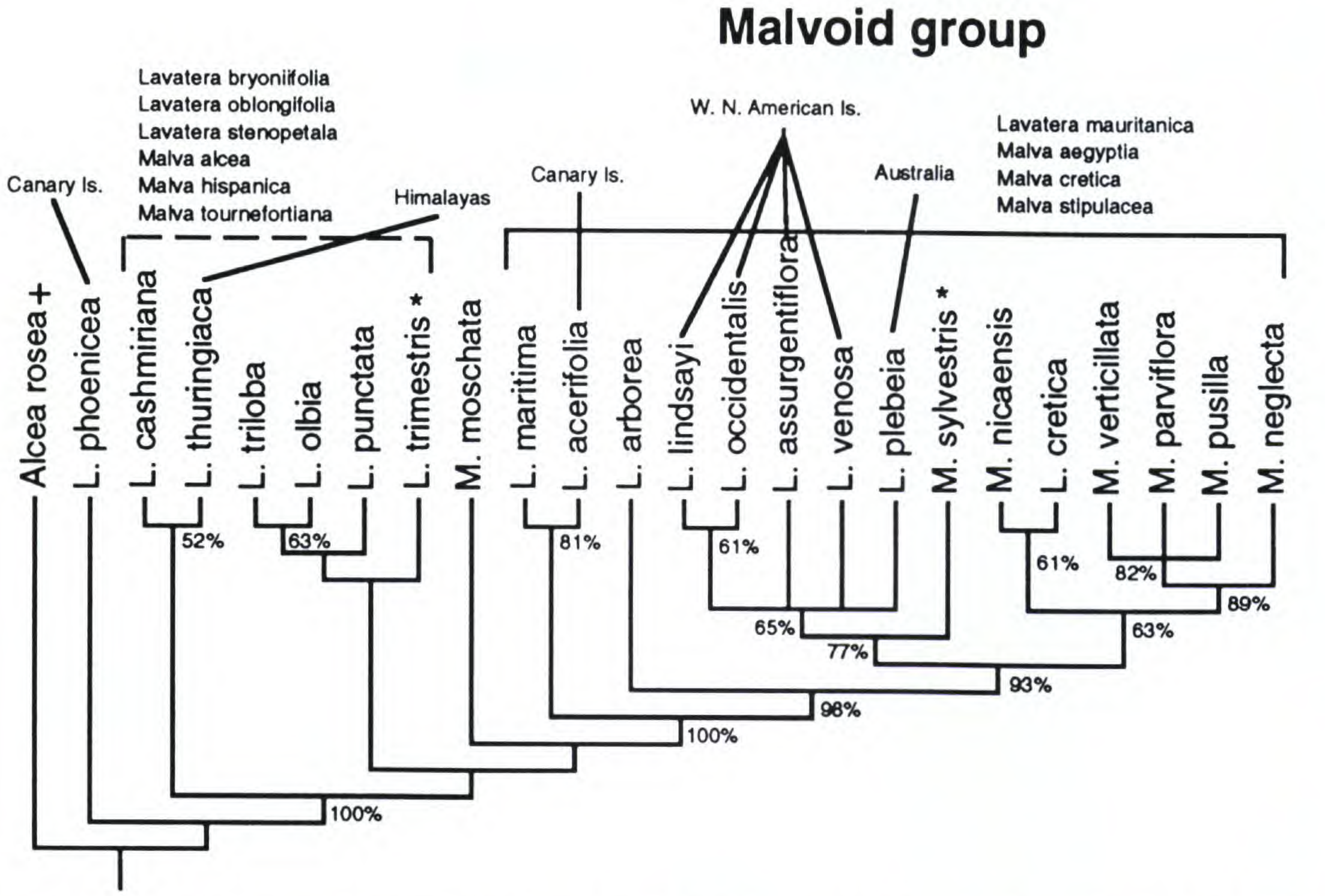


Figure 1. ITS rDNA sequence analysis of *Lavatera* spp., *Malva* spp., and the outgroup *Alcea rosea*. Refer to Ray (1994, 1995) for details of other outgroups, other trees found, morphological characters, and methods, etc. A strict consensus of two PAUP trees, length 367 steps, consistency index 0.719. Bootstrap values from 1000 replicates are shown on branches. The "Malvoid" group of those species closely related to *Malva sylvestris* L. based on fruit morphology and ITS analysis (bracket), outgroup (indicated by +), type species of genera (indicated by *), and notable geographic disjunctions in distribution are shown. Species not surveyed for ITS (smaller type, above group bracket) have been added to the Malvoid group by examination of fruit morphology. Another, more tentative group consisting of species related to *Lavatera trimestris* L. (also based on fruit morphology and ITS) is shown by a dashed bracket, with species above the bracket added based on fruit characters.

or edges, (c) completely or nearly completely enclose the seed, (d) do not separate readily from the seed, and (e) act as a dispersal unit. The Malvoid group includes cosmopolitan weedy species in both *Lavatera* and *Malva* and also includes the disjunct *Lavatera* species that occur in Australia and the New World (see Fig. 1).

Other species now in both *Lavatera* and *Malva* that are related to *Lavatera trimestris* L. (see Fig. 1) have fruits that differ from Malvoid group fruits in the following ways: (a) rounded axially and laterally on the abaxial side, (b) devoid of lateral angles or edges, being rounded in the position where Malvoid fruits have edges, (c) do not completely enclose the seed, (d) separate readily from the seed, (e) form more of a valve than a dispersal unit, and (f) are therefore something other than true mericarps. These species form a more tentative group that requires more work and are not further discussed here.

Alefeld (1862) proposed a significant rearrangement of the species in tribe Malvaeae, retaining some traditional genera with a much different mix of species, a return to a more narrow circumscription of *Lavatera*, and one new genus, *Axolopha*. Alefeld's (1862) work was not widely followed. His ideas were similar to my (Ray, 1994, 1995) conclusions in that the proposed genera included a mixture of species from different genera. Interest in Alefeld's (1862) work has resurfaced recently; Krebs (1994b) proposed as a genus *Dinacrusa* (formerly a subgenus of Alefeld's *Axolopha*) to include a mixture of species from *Althaea* and *Malva*. None of the species discussed by Krebs (1994b) were included in my (Ray, 1995) ITS study, so the ITS data cannot be used to evaluate Krebs's proposal. I did, however, examine morphological characters of some species Krebs (1994b) discussed, and these species were included in my (Ray, 1995) Malvoid group on the basis of fruit characters. Krebs (1994b) provided scanning electron micrographs of the schizocarps/mericarps of several of the species

he discussed, and these illustrations clearly show the characters that define my (Ray, 1995) Malvoid group and the genus *Malva*. Accordingly, the evidence suggests that the species discussed by Krebs (1994b) should be included in *Malva*, but I prefer to have the support of ITS sequence evidence before making further proposals. In another paper, Krebs (1994a) laid out a general scheme of changes he presumably intends to propose in the future (some aspects are proposed in the two papers cited here) with evidence in the form of a key. Certain yet-to-be-proposed aspects of this general scheme are clearly at odds with the evidence I presented in my earlier (Ray, 1995) paper, wherein I included a discussion of the scheme and the characters used in the accompanying key.

Keys and descriptions to the North American taxa in *Lavatera* discussed in this paper were provided by Fryxell (1988). In addition, a discussion and detailed description of *Lavatera lindsayi* Moran and *Lavatera occidentalis* S. Watson were provided by Moran (1996). Other species are discussed in detail by Fernandes (1968b, 1968–1969).

My research (see Ray, 1994, 1995) was initially focused on *Lavatera* as traditionally circumscribed and was expanded to include *Malva* when *Malva* was found to be too closely related to be used as an outgroup. A complete revision of *Malva* that includes studies of fruit characters and ITS rDNA sequence data is now badly needed. Studies of *Malva* must consider those species currently in *Lavatera* that are more closely related to the type species *Malva sylvestris* L. than they are to *Lavatera trimestris* L., that is, those in the Malvoid group. To promote understanding of relationships in the two genera and to aid future systematic work in these groups, the following new names and new combinations in *Malva* are proposed to accommodate some of the Malvoid-group species currently in *Lavatera*, until such time as a comprehensive revision of *Malva* can be completed.

1. Malva assurgentiflora (Kellogg) M. F. Ray, comb. nov. Basionym: *Lavatera assurgentiflora* Kellogg, Proc. Calif. Acad. Sci. 1: 14. 1854. *Althaea assurgentifolia* (Kellogg) Kuntze [misspelled], Revis. Gen. Pl. 1: 66. 1891. *Saviniona assurgentiflora* (Kellogg) E. Greene, Leafl. Bot. Observ. Crit. 2: 163. 1912. TYPE: U.S.A. California: Ventura Co., West Anacapa Island, 350′, 3 Oct. 1978, *Timbrook & Philbrick 652* (neotype, selected here, SBBG).

Saviniona dendroidea E. Greene, Leafl. Bot. Observ. Crit. 2: 161. 1912. TYPE: U.S.A. California: San Miguel Is., Sep. 1886, *Greene s.n.* (isotype, UC). Fryxell (1988) suggested a holotype might exist at ND-G; the curators there were unable to produce the specimen.

Saviniona suspensa E. Greene, Leafl. Bot. Observ. Crit. 2: 162. 1912. TYPE: U.S.A. California: San Diego (in cultivation), 1889, *Vasey s.n.* (holotype, US).

No material matching the protologue of *Lavatera assurgentiflora* Kellogg could be found at CAS, DS, JEPS, ND-G, or UC. Kellogg specimens may also be found at B, BM, F, GH, GRA, LE, NY, PH, and US (Stafleu & Cowan, 1976–1988), but searches of these institutions yielded no material that could be considered the type. Inexplicably, Greene (1912) wrote that Kellogg's description was based on a plant from near San Francisco, California (presumably cultivated or escaped). In the protologue, the only locality is given as "Anacapa Island" [singular], without citation of a type specimen as such. There are three islands in the small group called Anacapa, so the type locality is somewhat vague. It is likely that the type specimen was among those lost at CAS in the 1906 San Francisco earthquake and fire. Kellogg used the common name "Royal Mallows" and mentioned in his description the petals that become more reflexed as the flowers fade, and the "rising, falling, and ascending curve" of the peduncle. Both of these are very good diagnostic characteristics. Brandegee (1890) wrote that *L. assurgentiflora* was described from a specimen cultivated in a park in Santa Barbara, California, collected by "Dr. Trask," who was told that the seed came from "the island of Anacapa."

I attempted to find suitable material for neotypification at CAS, SBBG, and UC. I have selected a neotype for *L. assurgentiflora* Kellogg from among three SBBG specimens from Anacapa localities. This material, *Timbrook & Philbrick 652*, has good flowers and fruits. The leaves are relatively small, suggesting a drought-stressed condition that I have observed in various species in *Lavatera* and *Malva*.

Lavatera assurgentiflora Kellogg subsp. *glabra* Philbrick, in Power, California Islands: 177. 1980. TYPE: U.S.A. California: Los Angeles Co., Santa Catalina Is., Bird Rock, 23 Sep. 1961, *E. R. Blakley 4739* (SBBG, CAS). This collection, although specifically cited by Philbrick (1980) in his description, has not been annotated by him.

This name was originally applied to populations of *L. assurgentiflora* that occur on Santa Catalina and San Clemente Islands (the two southernmost islands in the California group). This subspecies was briefly mentioned but not recognized by Hill (1993).

The characteristics of subspecies *glabra*, as de-

scribed by Philbrick (1980), are much more obvious in living specimens than in dried material, and particularly in comparison to living specimens of subspecies *assurgentiflora* grown under common conditions. Even so, the subspecies is sufficiently distinct to be recognized on specimens such as *Raven 17579* (UC), *Junak 1847* (UC), *Blakley 6414* (CAS), 2 sheets of *E. R. Blakley 4739* (the type, cited above), as well as type material of synonyms cited below, all of which match material I have grown. Other collections from Santa Catalina Island and San Clemente Island annotated as subspecies *glabra* by G. Krebs appear to correspond partially to my concept of the subspecies in having glabrous leaves and larger flowers with unreflexed petal blades, but are not as clear a match in leaf shape for the living material I have seen, and may have been annotated on the basis of locality. Some dried specimens have lost their flower color. In addition to the glabrous leaves and column and erose petal apices described by Philbrick (1980), subspecies *glabra* has a lower (rather decumbent in comparison with subsp. *assurgentiflora*) overall growth form, a more mesophytic appearance, larger, more glossy, lighter green leaves with more rounded lobes, and larger flowers that are lighter in color and lack the reflexed blades of mature petals of subspecies *assurgentiflora.*

Living specimens I have grown display the characteristics described by Philbrick, in addition to the other characteristics mentioned above, and match those of the type. Vouchers representing specimens of subspecies *glabra* I have grown (*Ray 324, Ray 903*) are at UC. Subspecies *glabra* has an ITS rDNA sequence identical to that of subspecies *assurgentiflora* (Ray, 1995), so the two taxa are obviously quite closely related. Ray (1995) found cases of ITS variation with and without morphological variation (and vice versa), so at least in this group ITS characters alone do not clearly provide evidence for or against the recognition of subspecific taxa.

Subspecies *glabra* probably was much more widespread on Santa Catalina and San Clemente Islands in the past. It may not be restricted to the two southern islands; at least one specimen referable to subspecies *glabra* has been found on Santa Cruz Island (*Junak 1847*, 1990, UC). Philbrick (1980) stated that *L. assurgentiflora* does not occur in the wild on Santa Cruz Island, but that specimens were cultivated near a university field station and at Stanton Ranch on Santa Cruz Island. In my experience, subspecies *glabra* is rarely cultivated. The Junak specimen is apparently a wild collection. It is unclear whether this record indicates a wider historical distribution, a migration forming a zone in which both subspecies overlap, or merely a spread due to escape from cultivation. A careful and detailed field survey of extant populations on all the islands is badly needed before a positive determination of the status of this subspecies can be made.

The following synonyms of *L. assurgentiflora* subsp. *glabra* have been identified and typified:

Saviniona clementina E. Greene, Leafl. Bot. Observ. Crit. 2: 160. 1912. TYPE: U.S.A. California: San Clemente Island, June 1903, *B. Trask 282* (lectotype, here designated, US).

Greene's (1912) protologue stated ". . . a single tree on San Clemente Island, whence specimens were taken in June, 1903, by Blanche Trask." Fryxell (1988) suggested that the holotype of *Saviniona clementina* E. Greene might be found at ND-G; no collections that match the protologue were found there. At US I found *Trask 282* and *Trask 283*, collected on San Clemente Island in June 1903. These are from opposite ends of the island (in conflict with Greene's statement above); Greene (1912) did not give the exact location of the material he saw. These Trask specimens fall within my circumscription of subspecies *glabra.* Because I found no material that more closely matches the protologue, I have selected *Trask 282* as a lectotype.

Saviniona reticulata E. Greene, Leafl. Bot. Observ. Crit. 2: 161. 1912. TYPE: U.S.A. California: Los Angeles Co., Santa Catalina Is., Bird Rock, Feb. 1898, *B. Trask s.n.* (isotypes, K, US).

Fryxell (1988) indicated that the holotype of *Saviniona reticulata* E. Greene might be found at ND-G; no collections matching the protologue were found there. At K and US, I found Trask collections from the same date and location; I consider them to be isotypes. The K specimen includes the curious notation "Bud and fls. snow-white" despite the fact that it appears to be quite a normal specimen that falls within my circumscription of subspecies *glabra.*

2. **Malva australiana** M. F. Ray, nom. nov. Replaced name: *Lavatera plebeia* Sims, Bot. Mag. 48: pl. 2269. 1821. Not *Malva plebeja* Stevenson, Bull. Soc. Nat. Mosc. 29 (1856) I. 325. 1856. *Althaea plebeia* (Sims) Schultes ex Steudel, Nomencl. bot. ed. 2 i. 66. 1840–1841. TYPE: colored drawing (Sim's plate 2269) from a small plant raised in a pot at J. Knight's (1777–1855) Exotic Nursery, King's Road, Chelsea. Plants of Australian origin, probably grown from seed (but this is unknown).

Malva australiana (*Lavatera plebeia*) is a well-known Australian species (Barker, 1986; Hnatiuk, 1990; Marchant et al., 1987; Mitchell, 1983). G. Krebs annotated a number of K specimens of *Lavatera plebeia*. All of these specimens fall within my circumscription of *Malva australiana*. G. Krebs annotated one specimen as possibly the type of *L. plebeia*, but he has not published his reasons for selecting that particular specimen. It is possible that this material had the same origin as the seed from which the plants that Sims saw were grown at the nurseries mentioned in the protologue. However, it is probably not possible to determine this. Sims's plate 2269 and his description (from apparently different plants growing in the ground at the nursery of Whitley, Milne, and Brame) are in agreement, and plate 2269 can therefore be considered the type.

Two infraspecific taxa of *Lavatera plebeia* were recognized by G. Krebs among the K specimens mentioned above. These are variety *tomentosa* and subspecies/variety *plebeia* (the rank designations are mixed in Krebs's annotations). Judging from these and other specimens, Australian floristic treatments (as cited above), and the opinion of a colleague in Australia (J. Conran, pers. comm. 1996), I think there may be some validity to these infraspecific taxa, but a careful examination of living specimens in the field is needed. The live specimens I have examined all appear to correspond to variety *tomentosa*.

3. Malva canariensis M. F. Ray, nom. nov. Replaced name: *Lavatera acerifolia* Cavanilles, Anales Ci. Nat. 6: 339. 1803. Not *Malva acerifolia* Nuttall ex Walpers, Rep. 1: 296. 1842. *Saviniona acerifolia* (Cavanilles) P. Webb & Berthelot, Hist. Nat. Iles Canaries, Tome troisieme ("Phytographia Canariensis" 1836–1841), Paris, Bethune, (part 2 sec. 1): 31. *Malva acerifolia* (Cavanilles) Alefeld, Oesterr. Bot. Z. 12: 258. 1862, illegitimate, later homonym. *Althaea acerifolia* (Cavanilles) Kuntze, Revis. Gen. Pl. 1: 66. 1891. TYPE: Spain. Madrid: H. R. Mat. (Hortus Regius Matritensis, now known as Real Jardin Botánico), July 1803, ex Canariensis Seminibus (holotype, MA).

The July 1803 specimen, identified as the type by Garilleti (1993), has no collector or number notation. The protologue included the following: "Se cría en Tenerife, y se cultiva en nuestro Jardin: nació de semillas enviadas por el Ciudadano Broussonet." (It grows in Tenerife, and is cultivated in our garden: derived from seeds sent by citizen Broussonet.) Citizen Broussonet is probably Pierre Marie Auguste Broussonet (1761–1807) of Montpellier, who spent 1799–1803 in the Canary Islands (Stafleu & Cowan, 1976–1988). The handwriting on the specimen matches that in samples of Cavanilles's writing (Candollea 28: 433–434. 1973).

4. Malva dendromorpha M. F. Ray, nom. nov. Replaced name: *Lavatera arborea* L., Sp. Pl. 690. 1753. Not *Malva arborea* St. Hilaire, Fl. Bras. Mer. I 215, t. 135, f. 4 1827. *Malva arborea* (L.) P. Webb & Berthelot, Hist. Nat. Iles Canaries, 3(2, 1): 30, illegitimate, later homonym. *Althaea arborea* (L.) Kuntze, Revis. Gen. Pl. 1: 66. 1891, illegitimate, later homonym. TYPE: ex Hort. Upsala, *LINN 871.1* (lectotype, designated by Fernandes (1968b)).

5. Malva lindsayi (Moran) M. F. Ray, comb. nov. Basionym: *Lavatera lindsayi* Moran, Madroño 11: 158. 1951. TYPE: Mexico. Baja California: Guadalupe Is., Outer Islet (Isla Exterior), 16 Apr. 1948, *Moran 2944* (holotype, DS; isotypes, CAS, UC).

6. Malva linnaei M. F. Ray, nom. nov. Replaced name: *Lavatera cretica* L., Sp. Pl. 691. 1753. Not *Malva cretica* Cavanilles, Diss. 5: 280. pl. 138. f. 2. 1788. *Althaea cretica* (L.) Kuntze, Revis. Gen. Pl. 1: 66. 1891, illegitimate, later homonym. TYPE: ex Hort. Upsala, *LINN 871.10* (lectotype, designated by Fernandes (1968b)).

Fernandes (1968b) cited five synonyms of *Lavatera cretica* L.:

Lavatera cretica var. *stenophylla* Willkomm, in Willkomm & Lange, Prodr. Fl. Hispan. 3: 581. 1878. (Fernandes cited 1881; this date does not conform with information given in Stafleu & Cowan, 1976–1988). This variety was subsequently raised to specific rank as *Lavatera stenophylla* (Willkomm) Rouy, Fl. Fr. 4: 42. 1897, but if the epithet were used in *Malva* it would create a later homonym of *M. stenophylla* Hoffmanns. Verz. Pfl.-Kult., Nachtr. 2:156. 1828.

Lavatera silvestris Brot., Fl. Lusit. 2: 277. 1804. If the epithet were used in *Malva* it would create an orthographic variant and later homonym.

Lavatera Isabellae Sennen "in schede?" appears not to have been validly published. *Malva mauritiana* Willkomm, in Willkomm & Lange, Prodr. Fl. Hispan. 3: 581. 1878 (see note about date above) is already an orthographic variant and later homonym.

Malva willkommiana Scheele, Linnaea 21: 570. 1848, is the only name cited by Fernandes (1968b) that could potentially be used to replace *L. cretica*. A specimen collected by Willkomm in the region called Malagam is cited in the protologue without date or specimen number. Scheele's herbarium and types are "unknown" (Stafleu & Cowan, 1976–1988), but Willkomm types may be found at COI, which does not lend material from the Willkomm herbarium. I attempted to obtain information from COI on the existence of a type for *Malva willkommiana* Scheele, and/or a photograph or photocopy of potential types, but have received no reply, and so for the present time I must assume that the name cannot be applied.

7. **Malva occidentalis** (S. Watson) M. F. Ray, comb. nov. Basionym: *Lavatera occidentalis* S. Watson, Proc. Amer. Acad. Arts 11: 113, 124. 1876. *Althaea occidentalis* (S. Watson) Kuntze, Revis. Gen. Pl. 1: 66. 1891. *Saviniona occidentalis* (S. Watson) E. Greene, Leafl. Bot. Observ. Crit. 2: 163. 1912. TYPE: Mexico. Baja California: Guadalupe Is., 1875, *Palmer* 17 (holotype, GH not seen; isotypes, MO; also BM, CM, K, NY, PH not seen).

Lavatera insularis S. Watson, Proc. Amer. Acad. Arts 12: 249. 1877. *Althaea insularis* (S. Watson) Kuntze, Revis. Gen. Pl. 1: 66. 1891. *Saviniona insularis* (S. Watson) E. Greene, Leafl. Bot. Observ. Crit. 2: 163. 1912. TYPE: Mexico. Baja California: Coronado Islands, 25 Feb. 1876, *Cleveland s.n.* (holotype, GH not seen; isotype, UC).

8. **Malva pacifica** M. F. Ray, nom. nov. Replaced name: *Lavatera venosa* S. Watson, Proc. Amer. Acad. Arts 12: 249–250. 1877. Not *Malva venosa* Thunberg, Prod. Pl. Cap. 119. 1800. *Althaea venosa* (S. Watson) Kuntze, Revis. Gen. Pl. 1: 66. 1891. *Saviniona venosa* (S. Watson) E. Greene, Leafl. Bot. Observ. Crit. 2: 163. 1912. TYPE: Mexico. Baja California: San Benito Island, Dec. 1876, *T. H. Streets s.n.* (holotype, US).

Watson (1877) cited the type as "from San Benito Island [singular] . . . collected by Dr. T.H. Streets, U.S.N., December, 1875." Fryxell (1988) cited the type as "Dec 1876, Streets s.n., (US!)"; his citation of the date matches that on the specimen, whereas Watson's does not. Islas San Benitos consist of three small islands; Streets did not indicate on which of these the type specimen was found.

9. **Malva wigandii** (Alefeld) M. F. Ray, comb. nov. Basionym: *Axolopha wigandii* Alefeld, Oesterr. Bot. Z. 12: 259. 1862. TYPE: "Cerro San. Anton pr. urb. Malaga 1000–1500'" Apr. 1845, *Willkomm 858* (COI) (seen as illustrated by Fernandes, 1968b).

Lavatera maritima Gouan, Ill. Observ. Bot. 46. 1773. *Althaea maritima* (Gouan) Kuntze, Revis. Gen. Pl. 1: 66. 1891. TYPE: *LINN 871.5* (lectotype, selected here).

Lavatera africana Cavanilles, Diss. 5: 282, pl. 139, fig. 1. 1788. TYPE: *Broussonet* 291 (lectotype, selected by Fernandes (1968b), MA).

Lavatera maritima Gouan is the oldest name applicable to the material I include in my circumscription of *Malva wigandii*. The combination *Malva maritima*, however, would be a later homonym of *M. maritima* Lamarck, Fl. Fr. 3: 140. 1779 (= *Malva tournefortiana*) and also of *M. maritima* Salisbury, Prod. 381. 1796 (= *Althaea officinalis*). The next oldest applicable name is *Lavatera africana* Cavanilles; the combination *Malva africana* would be a later homonym of *M. africana* Miller ex Steudel, Nomencl. bot. ed. I. 506. Fernandes (1968b) described extensive evidence showing that *L. africana* Cavanilles is referable to *L. maritima*. Fernandes cited *Axolopha wigandii* Alefeld among the synonyms of *L. maritima* and provided an illustration of the type specimen of *A. wigandii*. I believe Fernandes was correct, so I am compelled to adopt *Malva wigandii* as the name to be applied to *Lavatera maritima* when that species is transferred to *Malva*.

Typification of *Lavatera maritima* Gouan: Gouan types are to be found at C, KEIL, LINN, MEL, P-HA, SBT, and UPS (Stafleu & Cowan, 1976–1988). The only material that might be connected with Gouan was found at LINN. Specimen *LINN 871.5* has a note "Gouan" in Linnaeus's hand. Fernandes (1968b: 409, footnote 2) suggested that *LINN 871.5* is a likely isotype, probably a duplicate given to Linnaeus by Gouan. Another specimen, *LINN 871.6*, has been identified by Fernandes as *L. maritima*, but cannot be connected with Gouan. I include both of these specimens within my circumscription of *Malva wigandii*. Gouan's illustration shows a tomentose plant of generalized "*Malva*-like" appearance, but lacks floral detail, and therefore does not clearly match any one species in *Lavatera* or *Malva*. His illustration cannot be used to establish application of the name. Gouan's description essentially refers to a tomentose shrub that has flowers with bluish (I interpret Gouan's "dilute caerulescens" to include lavenderish, particularly in comparison to other species) petals and dark, pur-

plish claws. Only two of the taxa I recognize are shrubs with flowers that might match that description, and only one of them is tomentose. In addition, the non-tomentose species (*Malva canariensis*) has a distinctive crinkled petal characteristic that was not mentioned by Gouan and does not match the petals shown in his illustration. Gouan mentioned that the flowers of his *L. maritima* were of a size similar to that of flowers of *Malva rotundifolia* L. (This name has recently been proposed formally for rejection in favor of *M. pusilla* Smith in Sowerby (Turland, 1996) after many years of de facto rejection by European workers, but apparently not by American (Morton, 1937, and later floristic works)—see also Dalby (1968) and others cited in Turland (1996).) *Malva pusilla* Smith in Sowerby has flowers about 11 mm in diameter (Dalby, 1968), much smaller than those of the material that matches other critical aspects of the description mentioned above, and much smaller than the apparent flower size in Gouan's illustration. There has been confusion about the small-flowered *Malva* species in modern times (Morton, 1937), and I suspect this was even greater in Gouan's time, so I am inclined to ignore this size difficulty. Given the above, I am using *Lavatera maritima* Gouan as the oldest name applicable to the material that I include in my circumscription of *Malva wigandii.* A thorough search has failed to turn up any other material that might be the type of *L. maritima.* I select *LINN 871.5* as the lectotype of *L. maritima.*

Fernandes (1968b) included in synonymy of *L. maritima* Gouan the following: *Lavatera bicolor* (Rouy) Stapf, Bot. Mag. pl. 8997. 1923. Basionym: *Lavatera bicolor* Rouy, J. Bot. (Morot) 1897: 86. No type was cited by Rouy, but the illustration by Staph may serve as type. *Lavatera rupestris* Pomel, Nouv. Mat. Fl. Atl.: 343. 1874. Typification of these names has not yet been possible, but both were reduced to varietal status within *L. maritima* following their publication (see Fernandes, 1968b). Fernandes (1968b) also cited other subspecies and varieties as synonyms of *L. maritima* Gouan, stating that all are environmental variations without taxonomic value.

The name *Lavatera bicolor,* cited as a synonym of *L. maritima* by Fernandes (1968b), is used in the horticultural trade in northern California, and may be established in horticultural use elsewhere. Some live specimens I have used in my studies were purchased under that name, but fall within my circumscription of *Malva wigandii.* These horticultural specimens were used in my rDNA ITS study (Ray, 1995) in addition to wild-collected material from Europe and north Africa, and all were found to be identical in ITS sequence. Specimens show some morphological variation among populations in various parts of Europe and north Africa, suggesting that two or more infraspecific taxa may be present. Several such taxa have been described within the synonyms of *M. wigandii,* but Fernandes (1968b) considered this variation to be environmental in nature. Detailed study of wild populations will be required to shed further light on the variation within *Malva wigandii.*

Lavatera mauritanica Durieu, in Duchartre, Rev. Bot. 2: 436 (1847), is probably in the Malvoid group and if so should be transferred to *Malva.* However, at present only morphological evidence is available to support this, and it is premature to propose a generic transfer until this species can be included in the ITS rDNA sequence studies, restriction fragment (RFLP) studies, and other investigations in progress.

Acknowledgments. I thank Paul Fryxell, Charles Jarvis (BM/LINN), Brent Mishler (UC), John Strother (UC), and Dieter Wilken (SBBG), and the curators of B, BM, C, CAS, DS, F, GH, GRA, K, KEIL, MEL, MO, ND-G, NY, PH, P-HA, SBT, UC, UPS, and US.

Literature Cited

Alefeld, F. G. C. 1862. Ueber die Malveen. Oesterr. Bot. Z. 22: 247–261.

Barker, W. R. 1986. *Lavatera.* P. 834 *in* J. P. Jessop & H. R. Toelken (editors), Flora of South Australia. S. Australia Government Printing Division, Adelaide.

Brandegee, T. S. 1890. Plants of Santa Catalina Island. Zoë 1: 107–115.

Dalby, D. H. 1968. *Malva* L. P. 251 *in* T. G. Tutin, V. H. Heywood, N. A. Burges, D. M. Moore, D. H. Valentine, S. M. Walters & D. A. Webb (editors), Flora Europaea. Univ. Press, Cambridge.

Fernandes, R. 1968a. *Lavatera* L. P. 251 *in* T. G. Tutin, V. H. Heywood, N. A. Burges, D. M. Moore, D. H. Valentine, S. M. Walters & D. A. Webb (editors), Flora Europaea, Vol. 2. Univ. Press, Cambridge.

———. 1968b. Contribuições para o conhecimento do gênero *Lavatera* L. I: Notas sobre algumas especies. Collect. Bot. (Barcelona) 7: 393–448.

———. 1968–1969. Contribuções para conhecimento do gênero *Lavatera* L. II: Taxonomia. Bol. Soc. Portug. Ci. Nat. (ser. 2a) 12: 67–103.

Fryxell, P. A. 1988. Malvaceae of Mexico. Syst. Bot. Monogr. 25: 1–522.

Garilleti, R. 1993. Herbarium Cavanillesianum. Fontqueria 38: 5–249.

Greene, E. L. 1912. The genus *Saviniona.* Leafl. Bot. Observ. Crit. 2: 159–163.

Hill, S. R. 1993. *Lavatera.* P. 751 *in* J. C. Hickman (editor), The Jepson Manual: Higher Plants of California. Univ. California Press, Berkeley.

Hnatiuk, R. J. 1990. P. 308 *in* Census of Australian Vascular Plants. Australian Government Printing Service Press, Canberra.

Krebs, G. 1994a. Taxonomische Untersuchungen in der Subtribus Malvinae. Feddes Repert. 105(1–2): 7–18.

———. 1994b. Taxonomische Untersuchungen in der Subtribus Malvinae II. *Dinacrusa*. Feddes Repert. 105(5–6): 299–315.

Linnaeus, C. 1753. Species Plantarum (1st ed. facsimile 1957). Ray Society, London.

Marchant, N. G., J. R. Wheeler, B. L. Rye, E. M. Barnett, N. S. Lander & T. D. MacFarlane. 1987. P. 145 *in* Flora of the Perth Region. Western Australia Herbarium, Perth.

Mitchell, A. 1983. Malvaceae. P. 128 *in* B. D. Morley & H. R. Toelken (editors), Flowering Plants in Australia. Rigby, Adelaide.

Moran, R. 1996. The flora of Guadalupe Island, Mexico. Mem. Calif. Acad. Sci. 19: 121–124.

Morton, C. V. 1937. The correct names of the small-flowered mallows. Rhodora 39: 98–99.

Philbrick, R. 1980. Distribution and evolution of endemic plants of the California Islands. Pp. 175–178 *in* D. M. Power (editor), The California Islands: Proceedings of a Multidisciplinary Symposium. Santa Barbara Botanic Garden, Santa Barbara, California.

Ray, M. F. 1994. A Contribution to the Systematics of *Lavatera* and *Malva* (Malvaceae) and Related Genera. Ph.D. Dissertation, University of California, Berkeley.

———. 1995. Systematics of *Lavatera* and *Malva*—A new perspective. Pl. Syst. Evol. 198: 29–53.

Stafleu, F. A. & R. S. Cowan. 1976–1988. Taxonomic Literature, 2nd ed. Regnum Veg. 94, 98, 105, 110, 112, 115, 116.

Tournefort, J. P. 1706. Suite de l'etablissement de quelque nouveaux genres de plants: *Lavatera*. Hist. Mém. Acad. Roy. Sci. 1706: pp. 83–87 of "Hist." (1st) section (*Lavatera* p. 86).

Turland, N. 1996. Proposal to reject the name *Malva rotundifolia* (Malvaceae). Taxon 45: 707–708.

Watson, S. 1877. *Lavatera venosa*. Proc. Amer. Acad. Arts 12: 249–250.

New Combinations in *Pecluma* (Polypodiaceae)

Alexandre Salino

Departamento de Botânica, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Av. Antonio Carlos, 6627, Pampulha, 31270-110, Belo Horizonte, MG, Brazil

ABSTRACT. As a result of examination of the fern types from Museu Nacional do Rio de Janeiro, Brazil, and the need for valid names for regional floras, the following new combinations are made: *Pecluma camptophyllaria* var. *macedoi*, *P. hoehnii*, *P. imbeana*, and *P. insularis*.

Pecluma was segregated from *Polypodium* by Price (1983); it differs from *Polypodium* by the short-creeping, unbranched rhizome, basally attached rhizome scales, terete, dark stipe, pectinate lamina, multicellular, unbranched acicular hairs, and multicellular branched or unbranched glandular hairs. This complex was studied monographically by Evans (1969).

Pecluma contains about 31 neotropical species; Price (1983) transferred 28 of these to *Pecluma*. Later, some new combinations were made by Lellinger (1984, 1987), Tryon and Stolze (1993), and Moran (1995). However, some Brazilian species were not examined or evaluated in these earlier papers.

Pecluma hoehnii (A. Sampaio) A. Salino, comb. nov. Basionym: *Polypodium hoehnii* A. Sampaio, Relat. Comiss. Linhas Telegr. Estratég. Mato Grosso Amazonas 5: 26, tab. 4. 1916. SYNTYPES: Brazil. Mato Grosso: Coxim, 2ª Cachoeira do rio, V/1911, *F. C. Hoehne 3808* (lectotype, designated here, R); *F. C. Hoehne 3803* (not seen); *F. C. Hoehne 3809* (not seen).

Pecluma hoehnii has a short-creeping rhizome with basally attached scales, terete stipe, multicellular hairs on costa and pinna margins, simple or forked glandular hairs on the abaxial side of laminar tissue, and forked receptacular paraphyses. It is similar to *Pecluma camptophyllaria* var. *macedoi* in having anastomosing venation (except at pinna apices) and the presence of capsular setae; it differs in the rachis 4.5–7 times longer than the stipe (1.5–3 times longer in var. *macedoi*), two pairs of pinnae reduced to auricles, laminar tissue with simple and 1–2-forked hairs, and receptacular paraphyses with two clavate branches. *Pecluma hoehnii* is known only from the type collections.

Pecluma imbeana (Brade) A. Salino, comb. nov. Basionym: *Polypodium imbeanum* Brade, Arq. Mus. Nac. Rio de Janeiro 34: 115. Est. I. Fig. 1. 1932. TYPE: Brazil. Rio de Janeiro: Santo Antonio do Imbé, *A. C. Brade & Santos Lima Jr. 11633* (holotype, R).

Pecluma imbeana has a black creeping rhizome up to 10 cm long, basally attached scales, stipes terete, spaced 0.7–1.0 cm apart, multiseptate hairs on the rachises adaxially, simple or forked glandular hairs on the abaxial side of the lamina, sori slightly elongate, and sporangial capsules rarely with hairs. It is close to *Pecluma recurvata* (Kaulfuss) Price, but differs by the shape and width of pinnae, and the presence of reduced pinnae. *Pecluma imbeana* is known only from the type collection.

Pecluma insularis (Brade) A. Salino, comb. nov. Basionym: *Polypodium insulare* Brade, Bradea 1: 7, tab. 3. 1969. TYPE: Brazil. Ilha de Trindade, *J. Becker 808* (holotype, HB not seen; isotype, R).

Pecluma insularis has laminae perfectly pectinate with numerous segments, creeping rhizomes with basally attached scales, stipes terete, multiseptate hairs on both sides of the lamina, and glandular hairs on the abaxial side. It resembles *Pecluma ptilodon* var. *robusta* (Fée) Lellinger and *Pecluma paradiseae* (Langsdorff & Fischer) Price by the habit and the shape of the lamina, but differs by the rachises, costae, and laminar tissue densely pilose on both surfaces, simple glandular hairs on the abaxial side of the lamina, veins 1–2-forked, and sporangia with one capsular hair (hairs sometimes absent).

Pecluma camptophyllaria var. **macedoi** (Brade) A. Salino, comb. nov. Basionym: *Polypodium macedoi* Brade, Arch. Jard. Bot. Rio de Janeiro 11: 30, t. 10, 11, fig. 3, 1951. *Polypodium camptophyllarium* var. *macedoi* (Brade) A. M. Evans, Ann. Missouri Bot. Gard. 55: 254. 1969. TYPE: Brazil. Minas Gerais: Ituiutaba, *Macedo 1098* (holotype, RB not seen).

This variety of *Polypodium camptophyllarium* had not yet been combined in *Pecluma*. It is known from Bolivia and Brazil (Minas Gerais) (Evans, 1969).

Acknowledgments. I thank the curator of the herbarium of the Museu Nacional do Rio de Janeiro for loan of the types. I also thank Alan R. Smith for valuable suggestions on the manuscript.

Literature Cited

Evans, A. M. 1969. Interspecific relationships in the *Polypodium pectinatum-plumula* complex. Ann. Missouri Bot. Gard. 55: 193–293.

Lellinger, D. B. 1984. New combinations and some new names in ferns. Amer. Fern. J. 74: 56–60.

———. 1987. Nomenclatural notes on some ferns of Costa Rica, Panama and Colombia—III. Amer. Fern J. 77: 101–102.

Moran, R. C. 1995. Five new species and two new combinations of ferns (Polypodiopsida) from Ecuador. Nordic J. Bot. 15: 49–58.

Price, M. G. 1983. *Pecluma*, a new tropical American fern genus. Amer. Fern J. 73: 109–116.

Tryon, R. M. & R. G. Stolze. 1993. Pteridophyta of Peru. V. Aspleniaceae–Polypodiaceae. Fieldiana, Bot. 32: 1–190.

Paepalanthus humilis Sano, a New Species of Eriocaulaceae from Bahia State, Brazil

Paulo Takeo Sano

Departamento de Botânica, Instituto de Biociências, Universidade de São Paulo, C.P. 11 461, 05422-970 São Paulo, SP, Brazil

ABSTRACT. *Paepalanthus humilis*, known only from Piatã, Bahia, Brazil, is described and illustrated. Its placement in *Paepalanthus* sect. *Actinocephalus* is clear, due to flowers and inflorescence features. The species is compared to *P. bahiensis* (Bongard) Kunth, *P. brachypus* (Bongard) Kunth, *P. ciliatus* (Bongard) Kunth, and *P. ochrocephalus* Koernicke, the species most similar to it.

RESUMO. *Paepalanthus humilis* é descrita e ilustrada. É incluída em *Paepalanthus* sect. *Actinocephalus* por características das flores e inflorescências. A espécie é comparada com *P. bahiensis* (Bongard) Kunth, *P. brachypus* (Bongard) Kunth, *P. ciliatus* (Bongard) Kunth e *P. ochrocephalus* Koernicke, as espécies mais próximas. *Paepalanthus humilis* é conhecida, até o momento, somente de Piatã, Bahia, Brasil.

Paepalanthus Kunth includes ca. 485 species (Mabberley, 1997) distributed in Africa, Central America, and South America. Central America has 13 species and Africa has 5, 2 of them endemic to Madagascar (Giulietti & Hensold, 1990). The greater number is concentrated in South America, in which 480 species occur in almost all countries of the continent (Moldenke, 1971). Central Brazil constitutes the center of diversity for the family, both in amount and diversity of species (Ruhland, 1914; Hensold, 1988). According to Giulietti and Hensold (1990), 407 species occur in this country, most of them endemic to the state of Minas Gerais.

Paepalanthus humilis Sano, sp. nov. TYPE: Brazil. Bahia: Piatã, estrada Piatã–Inúbia, a ca. 25 km NW de Piatã, 13°04′19″S, 41°55′24″W, 1370 m.s.m., campo rupestre, com campos gerais e solo arenoso adjacente, 24 Feb. 1994, *P. T. Sano, S. Atkins, C. M. Sakuragui, R. M. Harley & V. C. Souza, CFCR 14523* (holotype, SPF; isotypes, ESA, F, HUEFS, K, SP). Figure 1.

Planta humillima. Rhizoma usque 4.0 cm longum, proferens folia rosulata 1.5–3.0 cm alta. Rami folia rosulata longitudini superantes. Spathae usque 6.0 mm longae, truncatae.

Rhizome 1.0–4.0 cm long, from which arise rosettes of leaves 1.5–3.0 cm long. Leaves linear-lanceolate to lanceolate, 2.0–2.5 × 0.2–0.25 cm, adaxial surface puberulous to glabrescent, abaxial glabrous, margins with sparse, long cilia, apex acute, puberulous, base semiamplexicaul. Paraclades axillary to and longer than rosette leaves, 4.0–9.5(–17.5) cm long, sparsely villous, with long trichomes at the level of paracladial bract insertion; paracladial bracts lanceolate, 0.5–2.0 × 0.15–0.50 cm, ciliate, apex acute, base semiamplexicaul. Spathe 3.0–6.0 mm long, membranaceous, glabrescent, loose; apex truncate, ciliate, lacerate. Scape 1.5–3.0 cm long, sericeous with long trichomes in apical portion. Capitula 3.0–5.0 mm diam., 2.0–4.0 mm tall, semiglobose. Involucral bracts disposed in 2 series, castaneous, oblong to obovate, concave, 1.8 × 1.1 mm, ciliate, apex obtuse. Flowers ca. 38 per capitulum, with average of 29 staminate and 9 pistillate flowers in same capitulum. Floral bracts light castaneous, oblong to elliptic-oblong, naviculate, ca. 1.5 × 0.5 mm, abaxial surface densely hairy at apex, trichomes tuberculate, apex acute in staminate flowers and obtuse to rounded in pistillate. Staminate flowers pedicellate, pedicel ca. 0.3 mm long; sepals light castaneous, obovate, strongly concave, 1.3 × 0.6 mm, apex obtuse, abaxial surface hairy at apex, trichomes tuberculate; corolla infundibuliform, thick, 6-lobed, hyaline, lobes opposite, stamens acute, entire, lobes alternating with stamens bifid and shorter; stamens ca. 1.7 mm long; pistillodes 3, short-papillose. Pistillate flowers pedicellate; pedicel ca. 0.2 mm long; sepals light castaneous, spathulate, concave, 1.6 × 0.9 mm, apex obtuse, abaxial surface densely hairy at apex, trichomes tuberculate, ring of hairs present at base of sepals; petals hyaline, elliptic, acute, flat, ca. 1.7 mm long, densely hairy at margin except apex; staminodes present, ca. 0.1 mm, scale-like; gynoecium ca. 2.1 mm, style branches filiform, longer than appendage, appendage ca. 0.4 mm, short-papillose.

Paepalanthus humilis was collected in Piatã, in the Serra do Atalho, Chapada Diamantina, Bahia,

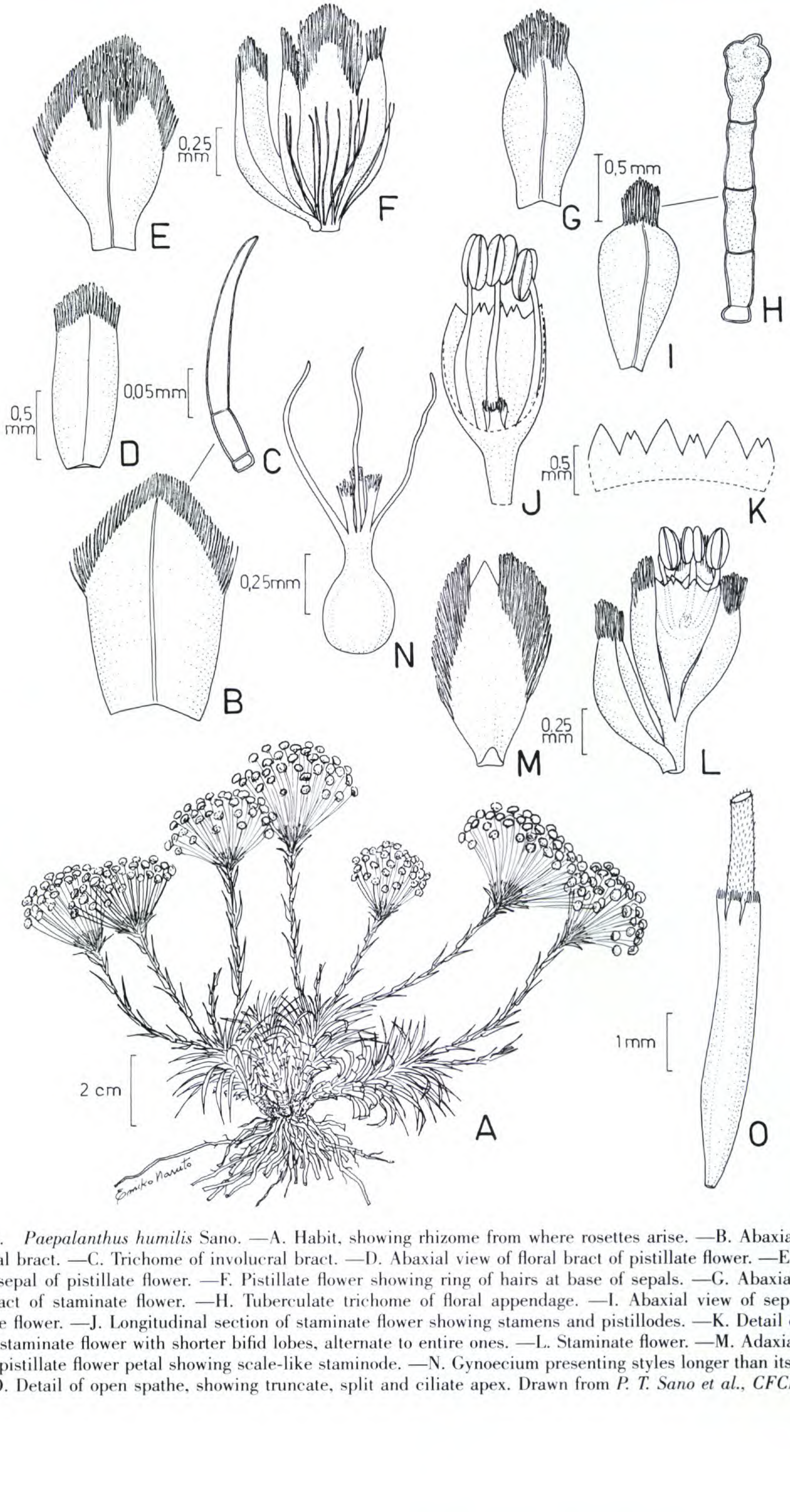


Figure 1. *Paepalanthus humilis* Sano. —A. Habit, showing rhizome from where rosettes arise. —B. Abaxial view of involucral bract. —C. Trichome of involucral bract. —D. Abaxial view of floral bract of pistillate flower. —E. Abaxial view of sepal of pistillate flower. —F. Pistillate flower showing ring of hairs at base of sepals. —G. Abaxial view of floral bract of staminate flower. —H. Tuberculate trichome of floral appendage. —I. Abaxial view of sepal in the staminate flower. —J. Longitudinal section of staminate flower showing stamens and pistillodes. —K. Detail of corolla lobes of staminate flower with shorter bifid lobes, alternate to entire ones. —L. Staminate flower. —M. Adaxial view of petal in pistillate flower petal showing scale-like staminode. —N. Gynoecium presenting styles longer than its appendage. —O. Detail of open spathe, showing truncate, split and ciliate apex. Drawn from *P. T. Sano et al., CFCR 14523.*

Brazil (13°04′19″S and 41°55′24″W), at 1372 m, growing in open sandy campo, between Gramineae and, at the moment, is known only from the type.

This species is placed in *Paepalanthus* sect. *Actinocephalus* Koernicke due to the following combination of features: scapes arranged in umbels, flowers trimerous, stigma simple, and trichomes tuberculate. The diagnostic features of *P. humilis* are the presence of tiny rosettes arising from the rhizome and the presence of reduced and truncate spathes. *Paepalanthus ciliatus* (Bongard) Kunth, *P. bahiensis* (Bongard) Kunth, *P. ochrocephalus* Koernicke, and *P. brachypus* (Bongard) Kunth are the most similar species with dwarf habits, a rare feature in *Paepalanthus* sect. *Actinocephalus*. However, *P. humilis* is the smallest species in the whole section, with rosettes less than 3.0 cm high, whereas *P. bahiensis*, the next smallest species, has rosettes higher than 10 cm.

Paepalanthus ciliatus is distinguished from *P. humilis* by the length of its spathes (16 mm), presence of a 3-lobed corolla in staminate flowers, style branches shorter than the appendage, and by its geographical distribution (endemic to Minas Gerais State). *Paepalanthus bahiensis* is distinguished by the presence of paracladia and stem leaves of the same size, the narrower and longer spathes (18.5 mm), which are glabrous, the staminate flowers having biparted corolla lobes, of the same size as the entire lobes, and by the pistillate flowers having style branches shorter than the appendage. *Paepalanthus ochrocephalus* is also known only from the type and is distinguished from *P. humilis* by the presence of divaricate trichomes on the margins of paracladial bracts, the length of the spathe (10 mm), the flexible and ridged scapes, and capitula with ochraceous hairs. *Paepalanthus humilis* has nondivaricate trichomes on the margins of paracladial bracts and presents erect and smooth scapes. *Paepalanthus brachypus* has longer leaves, which are linear, patent, and densely hirsute; paracladia slightly flattened, flexible, and as long as the leaves; and is endemic to the Diamantina region, Minas Gerais. *Paepalanthus humilis* has lanceolate to linear-lanceolate, puberulous leaves, and cylindric and erect paracladia.

Until now, five species of *Paepalanthus* sect. *Actinocephalus* were known from the state of Bahia: *P. polyanthus* (Bongard) Kunth, *P. hilairei* Koernicke, and *P. ramosus* (Wikström) Kunth, widely spread in the Brazilian "campos rupestres," and *P. ochrocephalus* and *P. bahiensis*, both endemic to Bahia. *Paepalanthus humilis* raises the number of species in *Paepalanthus* sect. *Actinocephalus* to 43 and raises the number of Bahian endemic species to 3.

Acknowledgments. The author is very grateful to Ana Maria Giulietti, Ray Harley, and Lucia Lohmann for corrections and critical comments, and to the Royal Botanic Gardens, Kew, for financial support during the expedition to Bahia.

Literature Cited

Giulietti, A. M. & N. C. Hensold. 1990. Padr es de distribuição geográfica dos gêneros de Eriocaulaceae. Acta Bot. Brasil. 4(1): 133–159.

Hensold, N. C. 1988. Morphology and systematics of *Paepalanthus* subg. *Xeractis* (Eriocaulaceae). Syst. Bot. Monogr. 23: 1–150.

Mabberley, D. J. 1997. The Plant-Book. A Portable Dictionary of the Higher Plants. Cambridge Univ. Press, Cambridge.

Moldenke, H. N. 1971. A Fifth Summary of the Verbenaceae, Avicenniaceae, Stilbaceae, Dicrastylidaceae, Symphoremaceae, Nyctanthaceae, and Eriocaulaceae of the World as to Valid Taxa, Geographic Distribution and Synonymy. 2 vols. Braun-Brumfield, Ann Arbor.

Ruhland, W. 1914. Zur geographischen Verbreitung der Eriocaulaceen. Bot. Jahrb. Syst., Suppl. 50: 363–374.

Novelties in Sauvagesioideae (Ochnaceae) from Venezuela and Guyana

Claude Sastre

Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle,
16 rue Buffon, F-75005, Paris, France

ABSTRACT. Three new species of Sauvagesioideae (Ochnaceae) are described: *Adenarake macrocarpa* Sastre from Venezuela, *Adenanthe ciliata* Sastre from Guyana, and *Tyleria terrae-humilis* Sastre from Venezuela.

During preparation of the Ochnaceae treatment for the *Flora of the Venezuelan Guayana*, I found collections representative of three unknown species of Sauvagesioideae (Ochnaceae), which are here described.

Adenarake macrocarpa Sastre, sp. nov. TYPE: Venezuela. Amazonas: Dpto. Atures, 115 km al SE de Puerto Ayacucho, caño Piedra, 04°54′N, 66°54′W, lomas graniticas, 1500 m, sep. 1989 (fr), *A. Fernandez, E. Sanoja & M. Yanez 6048* (holotype, PORT; isotypes, MO, P). Figure 1.

Ab *Adenarake muriculata* Maguire & Wurdack, laminis majoribus (8–9 × 2–2.2 cm vs. 5–8 × 1.8–2.5 cm), margine non glanduloso-ciliato, sepalis non glanduloso-ciliatis, capsula elatiore (24–25 mm longa vs. 12–13 mm), differt.

Herbaceous plant woody at base, 1.3 m tall, stems glabrous, ramification sympodial. Leaves membranaceous, elliptic, 8–9 cm long, 2–2.2 cm wide; apex acute, mucronate; margin serrate with small teeth; base attenuate; principal vein salient below, secondary veins subperpendicular at the principal vein, subparallel, 2–5 thin between 2 larger, a few ascending; petiole 1.5 cm long; stipules caducous, linear, 1 cm long, ciliate, glandular at margin and at apex. Inflorescence terminal on a sympodium, 15–22 cm long with a peduncle 7–9 cm long. Flower not seen. Fruit: capsule 3-valved, united at base, 2.4–2.5 cm long, 0.7 cm broad near the base, free part of the valve 17–18 mm long, 3 mm broad; sepals persistent, 5, ovate, 4–4.5 × 2–2.5 mm, coriaceous, margin with very small teeth (ca. 0.1 mm long), veins parallel, vertically ascending; some staminodes persistent, ovate, 2 × 0.5 mm; stamens persistent, anthers 2 × 0.5 mm, apiculate, dehiscence longitudinal, filaments 0.5 mm long. Bracts paired, ovate, 0.8–1.1 × 0.4–0.6 mm, denticulate-glandular. Young seeds not winged, mature seeds not seen.

Due to the secondary veins unequal in the membranaceous leaves, the ovary tricarpellate, and the seeds not winged, the new species is included in the genus *Adenarake*.

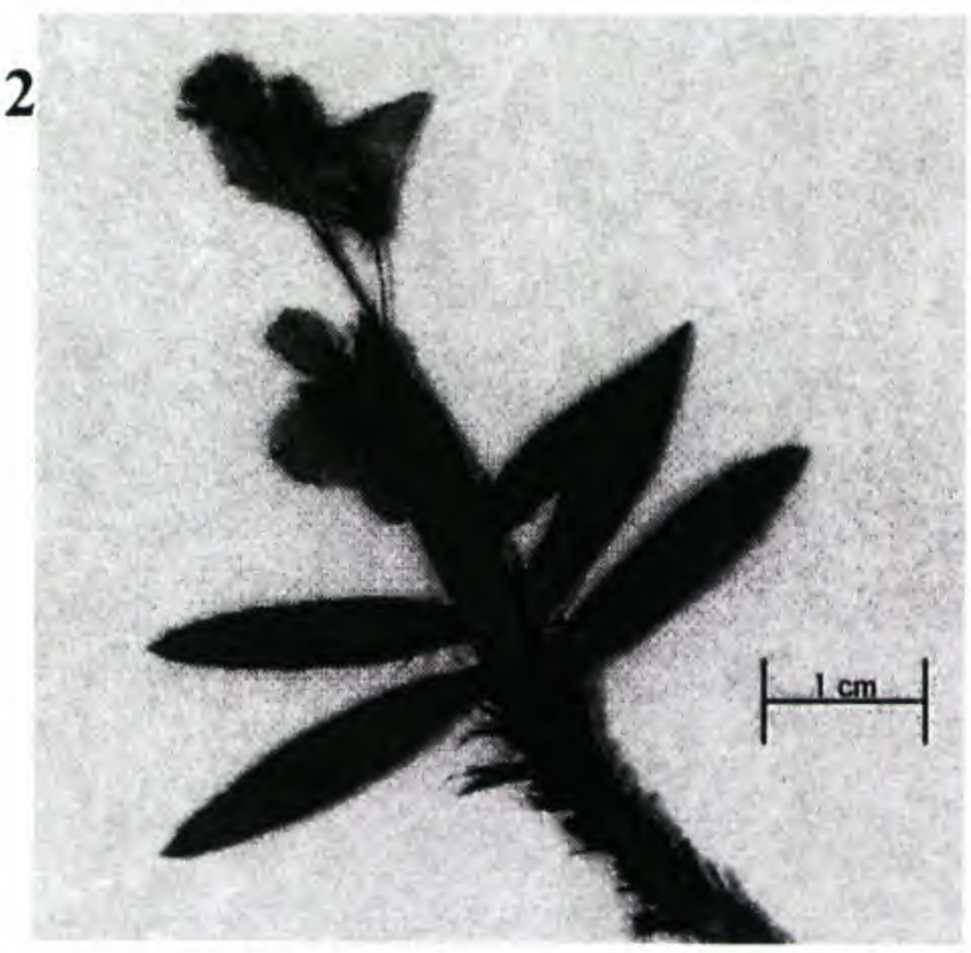
Until now, *Adenarake* was monospecific. *Adenarake macrocarpa* differs from *A. muriculata* Maguire & Wurdack by the longer leaves (8–9 cm vs. 5–8 cm), the margin not glandular-ciliate, the sepals not glandular-ciliate, and the capsule longer (24–25 mm vs. 12–13 mm).

Distribution. Known only from the type locality. Both *Adenarake* species are in Amazonas, Venezuela, *A. macrocarpa* at 115 km south-southeast of Puerto Ayacucho, *A. muriculata* on Cerro Neblina (frontier Venezuela–Brazil) 400 km south of the locality of the new species. Both are in highlands, the first on a granitic outcrop, the second on quartzitic rocks.

Adenanthe ciliata Sastre, sp. nov. TYPE: Guyana. Region Cuyuni–Mazaruni, Pakaraima Mts., NE plateau of Mt. Ayanganna, open scrub, trees to 8 m, moist slopes and small plateaus, occasional exposed sandstone, 05°23′N, 59°58′W, 1500–1650 m, 1 Nov. 1992 (fl), *T. W. Henkel & B. Hoffman 85* (holotype, P; isotype, US not seen). Figure 2.

Ab *Adenanthe bicarpellata* Maguire, Steyermark et Wurdack, stipulis non confertim ciliatis, bracteis non glandulosis, folii margine ciliato, staminodiis cum appendicibus filiformibus, differt.

Shrub 5 m tall, stems glabrous, bark black. Leaves sessile; stipules coriaceous, triangular, 7 mm high, 2 mm at base, apex acute, margin sometimes laciniate, denticulate at the base, nerves fine and parallel; blade coriaceous, 25–30 × 5–6 mm, elliptic, apex acute with a small mucro between 2 teeth, margin denticulate-ciliate, cilia 1 mm long, glandular at apex, smaller to 0.1 mm at the base of the leaf, base acute, secondary veins thin, parallel



Figures 1–3. —1. *Adenarake macrocarpa* Sastre; *Fernandez et al. 6048* (holotype, PORT). —2. *Adenanthe ciliata* Sastre; *Henkel & Hoffman 85* (holotype, P). —3. *Tyleria terrae-humilis* Sastre; *Yanez 436* (holotype, P).

ascending. Panicle terminal, 3–4 cm long; bracts ovate-triangular, coriaceous, 1.5 × 0.5 mm, poorly toothed; peduncle 1 cm long; sepals 5, ovate, 6 × 12 mm, margin ciliate-glandular, cilia 2–2.5 mm long; petals 5, spathulate, ca. 10 × 9 mm; inner staminodes, 5, united at the base, petaloid, narrowly obovate, 5 × 1.5 mm, alternating with free outer staminodes in 2 opposed circles of five each, appendix filiform, 2 mm long; stamens 5, sessile, ovoid, 3.5 × 0.8 mm, dehiscence longitudinal; ovary bicarpellate, 7 mm long with the style. Fruit not seen.

With the secondary veins of the coriaceous leaf blade thin and parallel ascending, the ovary bicarpellate, and the staminodes present, the new species is a good *Adenanthe*.

Until now, the genus *Adenanthe* was monospecific (Maguire & Wurdack in Maguire, 1961). *Adenanthe ciliata* differs from *A. bicarpellata* Maguire, Steyermark & Wurdack by the stipules not densely ciliate, bracts not glandular, margin of the leaves denticulate-ciliate, and the staminodes with 2 appendices at the base.

Distribution. Known only from the type locality. *Adenanthe bicarpellata* also occurs in Guyana in the Cuyuni–Mazaruni Region on Mt. Ayanganna, but in elfin forest at 1350–1380 m. In Venezuela *A. bicarpellata* occurs in Bolívar on the Chimanta

Massif and some neighboring tepuis at 2000–2150 m.

Tyleria terrae-humilis Sastre, sp. nov. TYPE: Venezuela. Amazonas: Dpto. Atabapo, San Antonio-Atabapo (abandoned settlement), 03°27′N, 66°45′W, en sotobosque medio ralo intevenido, 140 m, abr. 1990 (fl), *M. Yanez 436* (holotype, P; isotype, PORT not seen). Figure 3.

A *Tyleria apiculata* Sastre, foliis margine plano et dentibus sparsis, floribus minoribus sepalis inaequalibus 2.5–4 mm longis (vs. 8–9 mm), staminodiis 2-cyclicis, differt.

Shrub, 2 m tall, stems glabrous, ramification sympodial. Leaf blade papery, elliptic, 7–11 cm long, 1.4–1.8 cm wide; apex acute; margin poorly denticulate; base narrowly attenuate; principal vein salient on both surfaces, lateral veins parallel, numerous, with 3–5 thin between 2 larger, marginal vein salient on both surfaces. Petiole very short, less than 1 mm long. Stipules triangular, very short, height 1 mm, base 0.5 mm. Inflorescence terminal on each sympodium, paniculate, 7–8 cm long; inflorescence bract coriaceous, ovate-elliptic, 24 × 7 mm, apex emarginate with a tuft of cilia on each side of the notch, margin entire or slightly undulate; veins numerous, parallel, equal, margin vein a few salient. Floral bracts coriaceous, ovate, 2–2.5 × 0.4–0.6 mm, aristate. Peduncle 6–7 mm long; sepals 5, unequal, ovate, the smaller 2.5 × 2 mm, the larger 4 × 2 mm, apex obtuse in the smaller, acute in the larger, margin with some small teeth; petals 5, membranous, elliptic, 4 × 2 mm, apex acute; staminodes free, petaloid, elliptic, the 5 outer ca. 3 × 1.5 mm, the 5 inner ca. 2 × 1 mm; stamen poricidal, 2 × 0.5 mm; style 3 mm long. Mature fruit not seen.

Tyleria has 13 species, 4 clearly petiolate, 9 (including the new species) sessile or shortly petiolate. In the last group, 3 (including the new species) are subsessile and have inflorescences branched, with 10 flowers or more. In the last group, only *T. spathulata* Gleason possesses some spathulate leaves, while *T. apiculata* Sastre and *T. terrae-humilis* have elliptic to oblong leaves. The new species differs from *T. apiculata* by the plane margin of the leaves and smaller flowers poorly denticulate (sepals 2.5–4 mm long vs. 8–9 mm) and the staminodes free in 2 circles (vs. united at base in 1 circle).

Distribution. Known only from the type locality. The genus *Tyleria* is endemic to the Guayana Shield; *T. silvana* Maguire occurs in Venezuela (Serra de la Neblina) and Brazil (Serra Pirapucú); the other species are only in Venezuela, 2 in Bolívar state, 8 in Amazonas state; *T. apiculata* is in Bolívar state (Macizo del Chimantá) and in Amazonas state (Cerro Marahuaca). Only *T. terrae-humilis* is in the Guayana lowland (140 m), the other species are in the Guayana highland (1200–2500 m).

Acknowledgments. I thank the anonymous reviewer for assistance with the manuscript and Monique Chalopin for the photographic illustrations.

Literature Cited

Maguire, B. 1961. Ochnaceae. *In:* The Botany of the Guayana Highland—part IV(2). Mem. New York Bot. Gard. 10(4): 6–21.

Pitcairnia mirandae (Bromeliaceae)—A New Species from Chiapas, Mexico

John F. Utley and Kathleen Burt-Utley
Department of Biological Sciences, University of New Orleans,
New Orleans, Louisiana 70148, U.S.A.

ABSTRACT. *Pitcairnia mirandae* Utley & Burt-Utley (Bromeliaceae) is described as new from the state of Chiapas in Mexico. This new species is compared with *P. breedlovei* Lyman B. Smith, which it most closely resembles.

The variety of habitats in Chiapas (Miranda, 1952; Breedlove, 1973) is reflected in the ecological diversity and distribution of the 14 species of *Pitcairnia* known from the state. The ecological preferences of the species range from the dry forests or dry microhabitats within mesic forests where the deciduous taxa, *P. heterophylla* (Lindley) Beer and *P. karwinskyana* Schultes f., are typically encountered to the decidedly mesic formations preferred by *P. recurvata* (Scheidweiler) K. Koch and *P. undulata* Scheidweiler. Moreover, about one-half of these species are endemic to Chiapas and adjacent portions of Mexico and Guatemala (Utley & Burt-Utley, 1994). *Pitcairnia mirandae*, which we are proposing as a new species, occurs in the "Bosque Tropical Caducifolio" of Chiapas and is most similar to the Chiapan endemic, *P. breedlovei* Lyman B. Smith (Smith, 1966; Utley & Burt-Utley, 1994), which is known from "Bosques de Coniferas y Quercus."

Pitcairnia mirandae Utley & Burt-Utley, sp. nov. TYPE: Mexico. Chiapas: Municipio de Villa Corzo, 39.2 mi. S of MEX 190 E of Tuxtla Gutierrez along road to Revolución Mexicana, steep forested slopes above stream with rock outcrops, 2000 ft., 27 July 1992, *Utley & Utley 8800* (holotype, MEXU; isotypes, CAS, MO, US). Figure 1.

Planta herbacea caule. Inflorescentia paniculata pauciramosa vel racemosa. Sepala adaxialia pariter carinata. Petala testacea 3.5–4.1 cm longa. Ovarium ½–⅔ inferum.

Terrestrial herbs, acaulescent with a bulbous rosette when young becoming up to 4 dm caulescent with age; the stems typically covered by the densely imbricate leaf sheaths. Leaves entire, dimorphic, sheaths of both types clasping, broadly triangular, entire, 3–4 cm wide and 1.5–3.5 cm long, dark castaneous abaxially, pale to light brown adaxially, adaxially glabrous, abaxially glabrous basally becoming densely pubescent distally. Blades of the outer (lower) leaves soft spinose to linear, acuminate to attenuate, 0.2–0.3 cm wide and 1.5–15 cm long, glabrous adaxially, densely cinerous pubescent abaxially. Blades of the inner (upper) leaves linear to narrowly oblanceolate, long acuminate to attenuate, narrowed and somewhat channeled basally but not petiolate, 1–1.7 cm wide and 45–85 cm long, glabrous adaxially, densely cinerous pubescent abaxially. Scape erect, 39–49(–92) cm long, scattered- to floccose-lanate, becoming locally glabrous with age. Scape bracts strongly clasping and imbricate proximally becoming clasping and lax distally, exposing much of the rachis, blades erect to divergent or occasionally spreading; lowermost bracts resembling the outer leaves, sheaths broadly triangular (ovate), 1.5–2.5 cm wide and 2.5–3.5 cm long, cinerously floccose-pubescent becoming glabrous with age, castaneous to stramineous; blades 1–2 mm wide, 2–11 cm long, linear; middle bracts lacking clear distinction between blade and sheath, 0.8–1.1 cm wide, 10–30 cm long, narrowly ovate basally becoming narrowly triangular and attenuate distally, fugaciously cinerous-pubescent abaxially, glabrous to scattered lepidote adaxially; upper bracts reduced but similar to the middle bracts (occasionally with distinct, narrowly triangular blades), 3–6 cm long, 0.6–1 cm wide. Primary bracts with ovate sheaths and narrowly triangular, attenuate blades, spreading to subreflexed, 2.7–4.2 cm long, 0.6–1.1 cm wide, densely cinerous becoming glabrous with age abaxially, scattered lepidote adaxially. Inflorescence an erect 2–3-branched panicle or simple and racemose, laxly many-flowered, rachis (of compound inflorescences) 20–76 cm long; branches spreading to ascending (or the single, erect raceme in simple inflorescences), (11–)20–50 cm long, sterile basal portion 3–10 cm long, (8–)15–30-flowered. Floral bracts triangular, attenuate, scattered to subdensely lepidote, spreading to re-

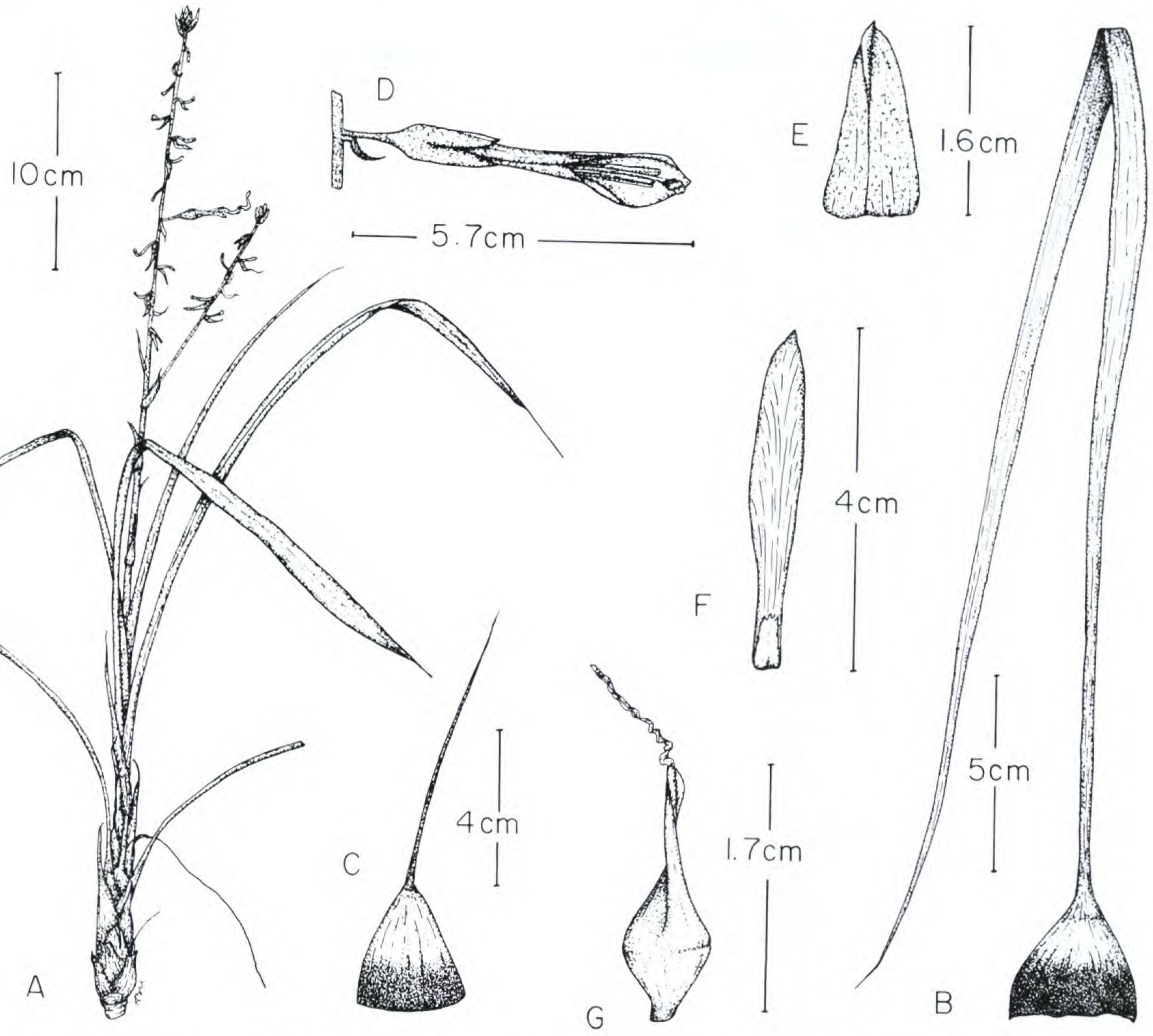


Figure 1. *Pitcairnia mirandae* Utley & Burt-Utley. —A. Habit. —B. Mature foliose leaf. —C. Mature spinose leaf. —D. Flower. —E. Adaxial sepal. —F. Petal. —G. Immature fruit (from *Utley & Utley 8800*).

Table 1. Comparison of the distinguishing characteristics of *Pitcairnia breedlovei* and *P. mirandae*.

Pitcairnia breedlovei	*Pitcairnia mirandae*
petals white to pale yellow	petals brick red
petals 4–4.5 cm long	petals 3.5–4.1 cm long
wings of adaxial sepals about 2 mm at widest point; conspicuously undulate-crisped	wings of adaxial sepals about 1 mm at widest point; even or appearing weakly irregular with 10× magnification
ovary at most one-half inferior	ovary one-half to two-thirds inferior

flexed, 1.3–2.7 cm long, 0.4–0.8 cm wide. Flowers spreading, pedicels 1–1.8 cm long, lepidote; sepals elliptic to broadly linear, acute and acuminate, 1.5–1.6 cm long, 0.4–0.5 cm wide, scattered cinerous lepidote, the adaxial pair keeled, becoming alate-keeled distally; corolla tubular, the petals torqued distally and forming an open hood over the anthers and stigma; petals narrowly obovate to subspathulate, broadly acute to subrounded, 3.5–4.1 cm long, about 0.8 cm wide, brick red, with a subbasal oblong, truncate to premose, occasionally erose appendage (occasionally deeply incised apically giving the appearance of a pair of erose appendages); stamens included, filaments 2.7–3.4 cm long, anthers basifixed, 0.3–0.7 cm long, hastate; ovary trigonous, one-half to two-thirds inferior; style about 3 cm long; stigma conduplicate spiral. Immature fruit lepidote proximally, about 1 cm diam. Immature seeds bicaudate.

Pitcairnia mirandae resembles *P. breedlovei* in its elongate caudex covered with leaf bases, dimorphic entire leaves, few-branched paniculate or racemose inflorescence, and winged posterior sepals. However, the two taxa are readily distinguished by the characters summarized in Table 1.

This species is named in honor of Faustino Miranda, whose work in Chiapas has contributed immeasurably to our knowledge of this floristically rich and ecologically complex state.

Paratypes. MEXICO. **Chiapas:** Municipio de Villa Corzo, steep-walled canyon with Tropical Deciduous Forest and Conglomerate bluffs 58 km S of Mexican Highway 190 on road to Nueva Concordia, 900 m, 11 Sep. 1974, *Breedlove 37555* (DS); about 39 mi. S of Mexican Highway 190 along road to Revolución Mexicana, steep-walled canyon along small stream, 1900–2000 ft., 31 July 1991, *Utley & Utley 8725* (MICH, SEL, XAL).

Acknowledgments. The authors thank the curators of CAS and MEXU for the loan of specimens or use of facilities important in this study.

Literature Cited

Breedlove, D. E. 1973. The phytogeography and vegetation of Chiapas (Mexico). Pp. 149–165 *in* A. Graham (editor), Vegetation and Vegetational History of Northern Latin America. Elsevier, Amsterdam.

Miranda, F. 1952. La Vegetación de Chiapas, 1. Ediciónes del Gobierno del Estado, Tuxtla Gutierrez, Chiapas.

Smith, L. B. 1966. Notes on Bromeliaceae, XXIV. Phytologia 13: 454–465.

Utley, J. & K. Burt-Utley. 1994. *Pitcairnia.* Pp. 91–98 *in:* G. Davidse, M. Sousa S. & A. O. Chater (editors), Flora Mesoamericana, Vol. 6. Alismataceae a Cyperaceae. Universidad Nacional Autónoma de México, México, D.F.; Missouri Botanical Garden, St. Louis; The Natural History Museum, London.

Species Status for a Sonoran Desert Annual Member of *Oenothera* sect. *Anogra* (Onagraceae)

Warren L. Wagner
Department of Botany, MRC 166, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.
Email: wagner.warren@nmnh.si.edu

ABSTRACT. The taxon most recently known as *Oenothera avita* W. Klein subsp. *arizonica* (Munz) Klein is here elevated to species level. It is easily distinguished from the perennial taxa of this complex, currently treated as three subspecies of *O. californica*, by its annual habit with a taproot, stems thickened near the base and tapering toward the apex, buds with conspicuous purple spots, each spot at the base of a long hair, longer attenuate capsules, and pinnatifid leaves.

In preparation of treatments for the *Flora of Arizona* and *Flora of North America* I here raise to specific level an annual member of *Oenothera* sect. *Anogra*. It has been most recently known as *Oenothera avita* Klein subsp. *arizonica* (Munz) Klein (Klein in Munz, 1965). In this paper I will review the biosystematic information about the plant and discuss why it should be treated at the rank of species.

Munz (1931) described *Oenothera deltoides* Torrey & Frémont var. *arizonica* Munz for the distinctive plants of *Oenothera* sect. *Anogra* with an annual habit from a taproot, stems thickened near the base and tapering toward the apex, buds with conspicuous purple spots, each spot at the base of a long hair, longer attenuate capsules, and pinnatifid leaves from the Sonoran Desert in central and southwestern Arizona. That these distinctive populations deserved formal recognition has never been questioned; rather the controversy has been at what taxonomic level they should be recognized and to what taxon they were most closely related. Because of its annual habit Munz (1931) included it in the annual desert species *O. deltoides*. William Klein transferred it, based on detailed biosystematic study of several species of *Oenothera* sect. *Anogra* from the western United States (1962, 1964, 1970, in Munz, 1965), to the perennial species *O. californica* (S. Watson) S. Watson in 1962. This species included four subspecies: subsp. *californica* from southern California, subsp. *avita* Klein from interior California to northern Arizona, Nevada, and southwestern Utah, subsp. *eurekensis* (Munz & Roos) Klein, and subsp. *arizonica*. He later restricted the circumscription of *O. californica* to include only the more western taxon (subsp. *californica*) of the complex because it was an autotetraploid, and the other taxa were diploid. He described a new species for the three diploid taxa, *O. avita* Klein. I have reviewed all of the information from past studies and compared the morphology in limited field studies and extensive herbarium study of all taxa included within *O. deltoides*, *O. californica*, and its segregate *O. avita*. Recently, I treated the perennial autotetraploid populations (*O. californica* s. str.) and the diploid ones (*O. avita*) as one species (Wagner, 1993) because they share many morphological features, the differentiating characters intergrade extensively, and the polyploid taxon is an autotetraploid of apparent recent origin. Here I discuss the data on the Arizona annual populations and provide justification for proposing the new combination to recognize it as a distinct species.

Klein transferred *Oenothera deltoides* var. *arizonica* to *O. californica* and then to *O. avita* primarily because it shared a high level of chromosomal end arrangements, differing from *O. californica* subsp. *avita* by only a single reciprocal translocation (5_{II} + ⊙ 4) in experimental crosses (1962, 1964, 1970). Additional data for his decision were obtained from pollen fertility of experimental hybrids. He easily obtained hybrids between the Arizona annual and both the perennial *O. avita* subsp. *avita* and *O. avita* subsp. *eurekensis*. The hybrids had 62–96% and 54–99% pollen fertility, respectively, a similar level of fertility found in crosses between the perennial taxa of the complex, but more variable and usually somewhat lower fertility than interpopulational within-taxon crosses (Klein, 1964, 1970). He also obtained hybrids between *O. avita* subsp. *arizonica* and two of the subspecies of *O. deltoides*, where this taxon had been originally placed by Munz. These hybrids had reduced pollen fertility ranging from 24% to 60%

(Klein, 1964, 1970). I concur with Klein that these data suggest that the Arizona annual appears to be less genetically differentiated from the perennial taxa of *O. avita* (= *O. californica*) than the annual taxa of the *O. deltoides* complex. Because crossability represents a plesiomorphic trait, these data do not necessarily reflect the relationships among the taxa and should be used with caution.

The primary reason I propose species-level recognition for the Arizona plants is that they are morphologically divergent from both *O. deltoides* and the perennial taxa I treat as *O. californica*, and are genetically differentiated based on crossing relations and chromosome end arrangements from *O. deltoides*. They are strikingly divergent morphologically from *O. californica* in the annual habit from a taproot, stems thickened at base and tapering toward the apex, buds with conspicuous purple spots, each spot at the base of a long hair, longer attenuate capsules, and pinnatifid leaves. They are at odds with placement back into *O. deltoides* because of the presumed relationships derived from Klein's work, although they share with it an annual taprooted habit, long attenuate capsules, and stems thickened basally.

Klein indicated allopatry for *Oenothera californica* and *Oenothera arizonica*, but also mentioned naturally occurring intermediates between them (1964, 1970), though he did not cite any collections or localities. I have studied material from throughout the range of *O. arizonica* and have not found any intermediates. *Oenothera arizonica* occurs in the northern portion of the Sonoran Desert east of the Colorado River from Maricopa and Yuma Counties east to Pima, Pinal, and Cochise Counties and scattered collections from northwestern Sonora, Mexico. *Oenothera californica* occurs exclusively west of the Colorado River in the southern part of its range and to the east of it only in Mohave County, Arizona, and southwestern Utah. I surmise that Klein's comment about intermediates must mean that he thought they approached each other morphologically.

Klein's study was done at a time when crossing studies and chromosome cytology were relatively new tools being successfully applied to a wide variety of systematic questions. At that time, the combination of limited knowledge of crossing patterns in *Oenothera* other than in section *Oenothera* and a strong emphasis on the phylogenetic value of the fertility of hybrids and cytological information led Klein to develop a classification that was more natural than previous ones, but that had very broadly delimited species. We now know that in *Oenothera* interspecific hybrids within a section nearly always are highly fertile (Stubbe & Raven, 1979; Wagner et al., 1985; Dietrich et al., 1985, 1997; Dietrich & Wagner, 1988; Wagner, unpublished), and thus high crossability alone usually is not a good basis for delimiting species in *Oenothera* or most other genera of the Onagraceae. I have not seen any intermediates between *O. arizonica* and any other taxa of the section, and see no reason to include *O. arizonica* within any other species, despite the viable hybrids that can be obtained experimentally, especially with the perennial *O. californica*. Another reason to treat them as distinct species is that they are geographically allopatric. By contrast, there is a broad range of intermediacy between the diploid *O. californica* subsp. *avita* and the autotetraploid *O. californica* subsp. *californica*. The single reciprocal translocation difference found by Klein between *O. arizonica* and *O. californica* would not be sufficient to treat *O. arizonica* as a distinct species since translocations are very common within many species of *Oenothera*. The distinctive annual habit along with the other morphological characters show that *O. arizonica* has differentiated relative to *O. californica*.

Oenothera arizonica (Munz) W. L. Wagner, comb. et stat. nov. Basionym: *Oenothera deltoides* Torrey & Frémont var. *arizonica* Munz, Amer. J. Bot. 18: 315. 1931. *Oenothera californica* (S. Watson) S. Watson subsp. *arizonica* (Munz) Klein, Aliso 5: 179. 1962. *Oenothera avita* (Klein) Klein subsp. *arizonica* (Munz) Klein, in Munz, N. Amer. Fl. ser. II, 5: 116. 1965. TYPE: U.S.A. Arizona: Pima Co., Grosetta Ranch near Tucson, 730 m, 28 Apr. 1903, *J. J. Thornber 509* (holotype, UC-128066 not seen; isotypes, MO, US-661488).

Oenothera deltoides Torrey & Frémont f. *floccosa* Munz, Amer. J. Bot. 18: 315. 1931. TYPE: U.S.A. Arizona: Maricopa Co., Tempe, 18–27 May 1903, *D. Griffiths 4317* (holotype, US-660165; isotype, MO).

Winter or spring taprooted, annual herb; stems 1–3.5(–6) dm long, thickened at the base and tapering toward the apex, unbranched or with few to several decumbent branches arising from the base, the older stems glabrate and the epidermis exfoliating, the younger portions sparsely to densely strigillose and sparsely to densely hirsute, the longer hairs straight or curved, erect or spreading, 1.3–2 mm long, sometimes the inflorescence and the flowers densely hirsute, the hairs then often crinkled or somewhat curled, and up to 2.5 mm long. Rosette leaves 5–10(–26) cm long, 0.6–1.5(–3.5) cm wide, lanceolate to oblanceolate, pinnatifid, apex acute,

base attenuate to the petiole, petiole 1.5–12 cm long. Cauline leaves 5–8(–15.5) cm long, 1–2 cm wide, lanceolate or oblanceolate, pinnatifid or sometimes coarsely serrate, the lobes sometimes widely spaced, apex acute to long-acute, base attenuate, petioles 0–5 cm long. Flowers axillary in the upper half of the stem, opening near sunset. Floral tube 2.6–3.1 cm long, yellowish green or flushed with red. Buds oblong to narrowly oblong-oblanceoloid, 1.2–1.6 cm long, without free sepal tips. Sepals 1.9–2.6 cm long, green, flushed with red and conspicuously purple-spotted, each spot at the base of a long hair, pubescence same as the floral tube. Petals 1.6–2.6(–3.6) cm long, white, yellow to pale yellow at the base, obcordate, fading pink to deep pink. Anthers 7–9 mm long; pollen 90–100% fertile. Filaments 9–15 mm long. Ovary 2.1(–6) cm long. Style 4.5–5 cm long; stigma elevated above the anthers at anthesis, the lobes 5–10 mm long. Capsules 3–8 cm long, 2.5–3.5 mm diam. at the base, woody at maturity, 4-angled especially toward the base, curved upward, cylindrical attenuate to the apex, pubescence similar to that of the ovary but less dense, the valves separating to the base, sinuous with the upper 5–7 mm often recurved. Seeds 1.6–1.9 mm long, the testa minutely ridged under magnification, light brown to yellowish brown with dark purple splotches. Chromosome number, $n = 7$ (7_{II}; ⊙4 and 5_{II}; 2 ⊙4 and 3_{II}; based on 6 individuals from one locality; Klein, 1964, 1970). Self-compatible, but mostly outcrossing (Klein, 1964, 1970).

Phenology. Flowering from February through May, but mostly in April, rarely in October (*Felger et al. 14982*).

Distribution. Occurring in gravelly or sandy soils, usually along watercourses or other disturbed sites, 270–1370 m elevation, in southern Arizona from Maricopa and Yuma Counties to Cochise County, and from scattered localities in northern Sonora, Mexico, including Cerro Tepopa, Puerto Libertad, and Tastiota. The populations from southwestern Arizona (Yuma Co.) southward to Sonora often grow on low dunes (R. Felger, pers. comm.).

Specimens examined. MEXICO. **Sonora**: NW side of Cerro Tepopa, ca. 10 mi. S of El Desemboque San Ignacio, dunes (29°22′N, 112°24′W), *Felger et al. 14982* (ARIZ, MO); coastal dunes 1 km S of El Desemboque San Ignacio (vicinity 29°30′N, 112°28′W), *Felger et al. 12443* (ARIZ), *Felger & Edmundson 16995* (ARIZ); desert plain near N side of Cerro Tepopa, 0.5 mi. W of 9.2 mi. by road S of El Desemboque San Ignacio (29°23′N, 112°25′W), *Felger et al. 14122* (ARIZ); 13.2 mi. by road S of El Desemboque San Ignacio, middle bajada, *Felger & Bezy 14173* (ARIZ); 6 km S of Puerto Libertad, edge of big dune, 24 Feb. 1978, *Martin* (ARIZ); 1.8 km NNE of Punta Cirio, Sierra Bacha, 7.2 km (by air) SE of Puerto Libertad, on Pleistocene dunes, 30 m, 29°51′10″N, 112°38′20″W, *Van Devender et al. 91–27* (ARIZ); ca. 1 mi. NW of Tastiota, high beech dunes, vicinity 28°20.5′N, 111°30.3′W, *Felger et al. 20872* (ARIZ). U.S.A. **Arizona**: Maricopa Co., Gila River Canyon, *Mohr 273* (US); near Marinette [33°35′44″N, 112°16′47″W], *Peebles & Loomis 6709* (US); Salt River bottom lands near Phoenix, *Nelson & Nelson 1683* (MO), *Gillespie 5627* (US); Stewart Mt., near Salt River [33°34′55″N, 111°33′25″W], *Gillespie 5465* (US); 1.3 mi. SE of Surprise, along Hwy. 60–89–93 in Sun City [33°35′51″N, 112°16′16″W], *Wagner & Mill 4567* (MO), *Mill & Wagner 8* (MO); vicinity of 91 Ave. and the Gila River, SW Phoenix, *Lehto & Schuessler 18050* (MO); Jct. Baseline Rd. and 91st Ave. growing with *O. deltoides* subsp. *deltoides*, *Rea 790* (ARIZ). Pima Co., near Growler Pass [32°11′N, 112°55′W], *Kearney & Peebles 10856* (US); sparingly on mesa about Tucson, *Toumey 157* (US); Tucson, 4 May 1905, *Wilcox s.n.* (US); vicinity of Tucson, *Rose 11878* (US); near Tucson, *Peebles, Harrison & Kearney 1273* (US); Santa Cruz Valley, Grosetta's Ranch, 29 Apr. 1902, *Thornber & Thornber s.n.* (MO), 12 May 1903, *Thornber & Thornber s.n.* (MO). Pinal Co., near Florence [33°15′34″N, 111°20′11″W], *Peebles 1688* (US); near Sacaton [33°04′N, 111°44′W], *Peebles 1730* (MO); Casa Grande, *Peebles & Harrison 3536* (US); Gila River near Casa Grande Ruins [National Monument, 32°59′49″N, 111°31′53″W], *Nelson & Nelson 1678* (MO, US). Yuma Co., Pinta Sands along Camino del Diablo, Cabeza Prieta National Wildlife Refuge (32°08′N, 113°33′W), dunes, *Felger & Huddy 92–36* (ARIZ [2], MO). Without further locality, *Palmer 596* (US).

The specimen from Yuma Co., Pinta Sands along Camino del Diablo, Cabeza Prieta National Wildlife Refuge (*Felger & Huddy 92–36*) is a large phenotype of *Oenothera arizonica*. It differed from all other specimens only in the size of both the vegetative parts and the flowers, and all of the atypical measurements given in the description are from this specimen except for stem length. It may represent a robust form that grows on dunes. *Oenothera arizonica* typically grows on dunes in Sonora, but rarely so in Arizona. Populations growing on dunes should be studied further and compared to non-dune populations in the northern and eastern portion of the range.

Acknowledgments. I appreciate the useful comments on a draft of this manuscript by Werner Dietrich, Peter Hoch, and Robynn Shannon. Richard Felger kindly provided copies of the specimen records from ARIZ and useful comments on the species distribution and ecology.

Literature Cited

Dietrich, W. & W. L. Wagner. 1988. Systematics of *Oenothera* sect. *Oenothera* subsect. *Raimannia* and subsect. *Nutantigemma* (Onagraceae). Syst. Bot. Monogr. 24: 1–91.

———, P. H. Raven & W. L. Wagner. 1985. Revision of *Oenothera* sect. *Oenothera* subsect. *Emersonia* (Onagraceae). Syst. Bot. 10: 29–48.

———, W. L. Wagner & P. H. Raven. 1997. Systematics of *Oenothera* sect. *Oenothera* subsect. *Oenothera* (Onagraceae). Syst. Bot. Monogr. 50: 1–234.

Klein, W. M. 1962. New taxa and recombinations in *Oenothera (Anogra)*. Aliso 5: 179–180.

———. 1964. A Biosystematic Study of Four Species of *Oenothera* Subgenus *Anogra*. Ph.D. Thesis, Claremont Graduate School, Claremont, California.

———. 1970. The evolution of three diploid species of *Oenothera* subgenus *Anogra* (Onagraceae). Evolution 24: 578–597.

Munz, P. A. 1931. Studies in Onagraceae VI. The subgenus *Anogra* of the genus *Oenothera*. Amer. J. Bot. 18: 309–327.

———. 1965. Onagraceae. N. Amer. Fl. II. 5: 1–278.

Stubbe, W. & P. H. Raven. 1979. A genetic contribution to the taxonomy of *Oenothera* sect. *Oenothera* (including subsections *Euoenothera*, *Emersonia*, *Raimannia*, and *Munzia*). Pl. Syst. Evol. 133: 39–59.

Wagner, W. L. 1993. Onagraceae (family description and key), *Camissonia*, *Gaura*, and *Oenothera* (Onagraceae). Pp. 776–786, 798, 800–804 *in* J. C. Hickman (editor), The Jepson Manual: Higher Plants of California. Univ. California Press, Berkeley, California.

———, R. E. Stockhouse & W. M. Klein. 1985. The systematics and evolution of the *Oenothera caespitosa* species complex (Onagraceae). Monogr. Syst. Bot. Missouri Bot. Gard. 12: 1–103.

A New, Dioecious Species of *Hedyotis* (Rubiaceae) from Kaua'i, Hawaiian Islands, and the Taxonomy of Kaua'i *Hedyotis schlechtendahliana* Resolved

Warren L. Wagner
Department of Botany, MRC-166, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.
Email: wagner.warren@nmnh.si.edu

David H. Lorence
National Tropical Botanical Garden, P.O. Box 340, Lawai, Hawaii 96765, U.S.A.
Email: lorence@ntbg.org

ABSTRACT. A new, cliff-dwelling species, *Hedyotis flynnii,* is described from the Hawaiian island of Kaua'i. It is distinguished by its conspicuously reticulate leaf venation, reduced leaves, and greenish yellow or sometimes white corollas. Based on morphological observations, it appears to be the first species in the genus known to have a dioecious breeding system. *Hedyotis flynnii* also expresses a strong corolla size dimorphism, with staminate flowers much larger than the pistillate. The taxonomy of the polymorphic species *Hedyotis schlechtendahliana* also is reconsidered recognizing the northwestern Kaua'i populations as *Hedyotis schlechtendahliana* subsp. *waimeae,* characterized by stiffly chartaceous to coriaceous reticulate leaves, open inflorescences, and subulate bracts and calyx lobes.

A distinctive, cliff-dwelling species of *Hedyotis* was first recognized as possibly a new species in Limahuli Valley by Tim Flynn and Moses Bergau in 1985. Additional collections from valleys along the Na Pali coast of Kaua'i, especially from Kalalau, established that it represented a new species. We now have ample material to ascertain that these populations represent a new species in the complex *Hedyotis* sect. *Wiegmannia* (Meyen) Fosberg. We also provide new analysis of a vexing problem in the complicated variation pattern in the related *Hedyotis schlechtendahliana* subsp. *schlechtendahliana,* treated as a very polymorphic variety in the most recent treatment by Wagner et al. (1990) and as four species by Fosberg (1943). We were able to clarify the taxonomy of this complex by study of numerous additional collections made during the past 10 years on Kaua'i, especially the northern half of the island. Our conclusion is that two morphologically distinctive subspecies with only partially overlapping ranges can be recognized.

HEDYOTIS FLYNNII

Hedyotis flynnii W. L. Wagner & Lorence, sp. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Na Pali Coast, Hono o Na Pali Natural Area Reserve, Waiahuakua Valley, back of valley by main waterfall, on cliffs W of main falls, 1500 ft. (457 m), 24 Jan. 1993, *Perlman & Flynn 13270* (holotype, PTBG; isotypes, BISH, US). Figure 1.

Species *Hedyoti parvulae* affinis, sed foliis nervis tertiarius valde reticulatis, corolla cum tubo viridi vel viridiflavo, corolla lobis albis vel viridi-flavis, corolla tubo 2- vel 3.1-plo lobis differt.

Compact shrubs (2–)3–7.5(–10) dm tall, many-branched; stems glabrous, young stems 4-costate, older stems 2-costate with bark weakly exfoliating. Leaves petiolate, usually closely spaced and overlapping, gradually reduced distally along the stem, coriaceous, lanceolate to ovate, rarely linear-lanceolate, 2–6 cm long, 0.5–1.5(–2.2) cm wide, the base cuneate, rounded or rarely truncate (Limahuli and Hanakapiai Valley collections), the apex long acuminate to long attenuate, often falcate, the lateral veins 2–4 on each side, strongly ascending, prominent on both surfaces, the tertiary venation prominently reticulate on both surfaces, the margins flat to occasionally weakly revolute, the petioles 0.2–0.8 cm long, glabrous, the petioles, stipules, and venation often with reddish purple tinge; stipules deltate, glabrous, aristate, the apex with a stiff awn 1.5–5 mm long. Flowers in dense, 7–15-flowered, corymbiform inflorescences subtended by a pair of ovate bracts, inflorescence branches and pedicels subtended by smaller bracts; flowers dimorphic and the plants apparently dioecious, the calyx lobes oblong or ovate to narrowly triangular-

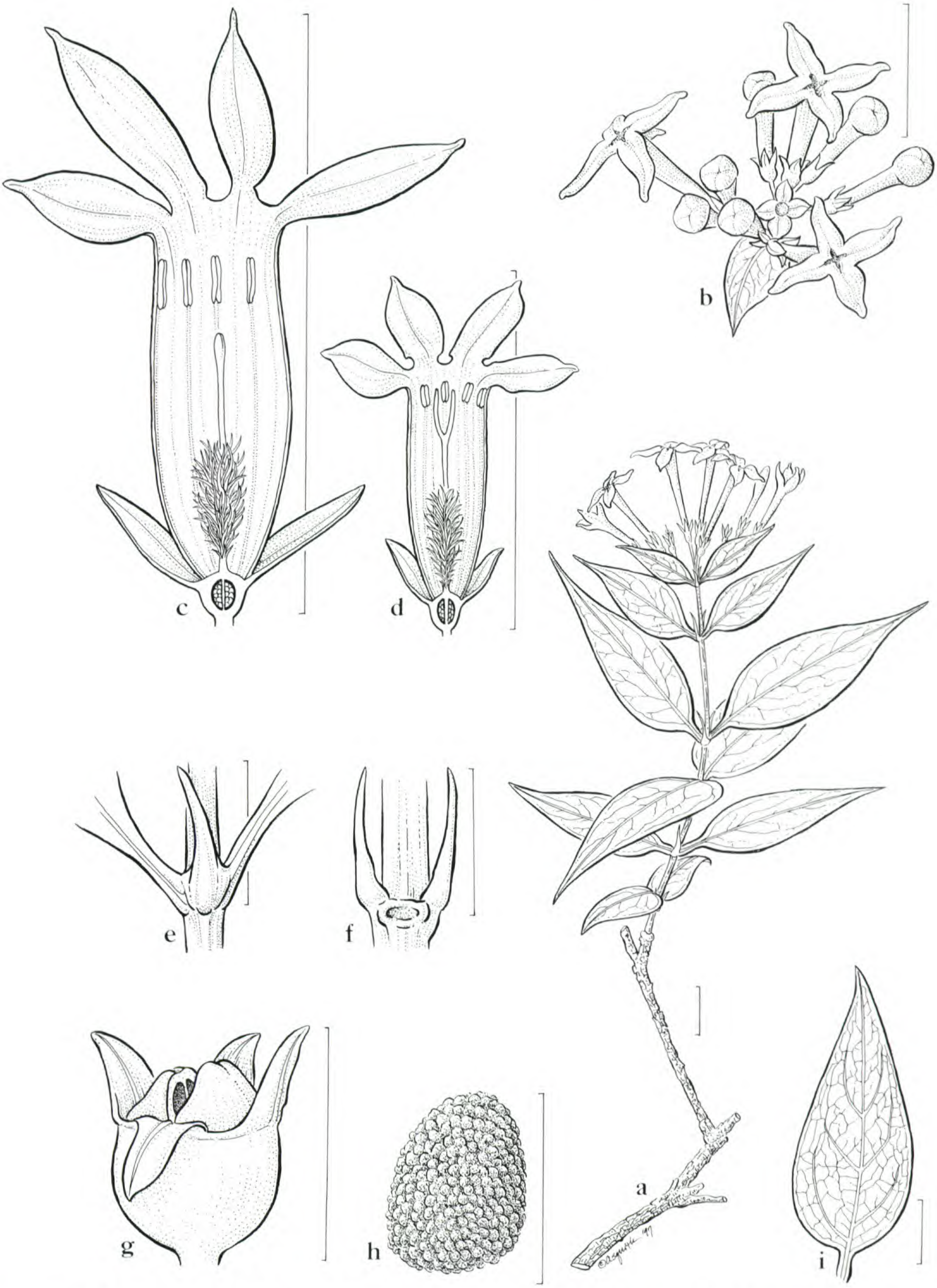


Figure 1. *Hedyotis flynnii* W. L. Wagner & Lorence. —a. Staminate flowering stem. —b. Inflorescence, top view. —c. Staminate flower, longitudinal dissection. —d. Pistillate flower, longitudinal dissection. —e. Stipule. —f. Stipule with petiole removed. —g. Dehisced capsule. —h. Seed. —i. Leaf, showing detail of venation. (a, e, f, i drawn from *Perlman & Flynn 13270*, the holotype; b from photo of *Lorence 6718*; c, d from *Wood 627*; and g, h from *Wood 1240*.) Bar scale = 10 mm in a, i; 24 mm in c; 13 mm in d; 6 mm in e, f; 8 mm in g; and 0.75 mm in h.

subulate, 2–6 × 0.5–2 mm, subequal, rigid, venose; corolla salverform, the valvate lobes conspicuously inflexed in bud, the apex depressed in bud, the tube greenish white or rarely with pink tinge, the lobes pure white or greenish white at anthesis; *staminate flowers* with the corolla tube 11–14 mm long, 2–2.5 mm diam., the lobes elliptic to oblong-lanceolate, 7.5–8 × 1.5–2 mm, the stamens inserted 2–4 mm below apex of tube, the anthers 1.8–2.8 mm long, the filaments 0.2–0.5 mm long, the style 5–8 mm long, 0.5–0.7 times the length of the tube, woolly-villous in lower ⅓–½, the stigma lobes poorly developed, coherent, ovules present at anthesis, but apparently never developing; *pistillate flowers* with the corolla tube 7–8 mm long, 1.2–1.5 mm diam., the lobes 2.5–4 × 0.8–1.5 mm, the stamens inserted 1–3 mm below apex of tube, the anthers 0.8–1.5 mm long, pollen not developing, the filaments 0.3–0.5 mm long, the style 6–8 mm long, 0.8–1.1 times the length of the tube, woolly-villous in lower ⅓–½, the stigma lobes ovate-elliptic, 1–1.5 mm long, free. Capsules subglobose, 5–6 mm long, 5–6.5 mm diam., dehiscing loculicidally across the disk, later weakly separating septicidally, the calyx lobes accrescent, erect, the disk raised, 1.5–2 mm long, the ovary ⅔ (rarely to ½) inferior; seeds irregularly ellipsoid-angulate or subglobose-angulate, 0.6–0.9 mm long, the testa dark brown or black, papillose.

Distribution, habitat, and ecology. Known only from northern and northwestern Kaua'i from the following valleys along the Na Pali coast: from Limahuli and Hanakapiai Valleys in the east (350–426 m elevation), to Kalalau Valley where the majority of collections have been made, and to Honopu, Pohakuao, Awa'awapuhi, Nualolo, and Kawaiula Valleys in the west (450–1100 m elevation).

Hedyotis flynnii is usually restricted to north- and northeast-facing cliffs and steep, narrow ridge crests and outcrops, less commonly occurring on steep rocky slopes and the upper portions of basalt cliffs. It generally occurs in windswept areas in small populations of 30 to 50 scattered plants or more in relictual lowland and montane diverse mesic forest and shrubland. Associated tree species include *Metrosideros polymorpha* Gaudichaud-Beaupré, *Acacia koa* A. Gray, *Diospyros sandwicensis* (A. DC.) Fosberg, *Psydrax odorata* (J. R. Forster) A. C. Smith & S. Darwin, *Myrsine linearifolia* Hosaka, *Eurya sandwicensis* A. Gray, *Exocarpus luteolus* C. N. Forbes, and *Alphitonia ponderosa* Hillebrand. Associated shrubby taxa include *Chamaesyce eleanoriae* Lorence & W. L. Wagner, *Alyxia oliviformis* Gaudichaud-Beaupré, *Dodonaea viscosa* Jacquin, *Nototrichium divaricatum* Lorence, *Coprosma* sp., *Dubautia* sp., *Vaccinium* sp., *Lobelia niihauensis* H. St. John, *Lysimachia* spp., *Sida* sp., *Hibiscus kokio* Hillebrand ex Wawra subsp. *saintjohnianus* (M. J. Roe) D. M. Bates, *Styphelia tameiameiae* (Chamisso & Schlechtendal) F. v. Mueller. Associated herbaceous taxa include *Bidens sandvicensis* Lessing subsp. *sandvicensis*, *Eragrostis* spp., *Poa mannii* W. Munro ex Hillebrand, and *Stenogyne campanulata* S. Weller & A. Sakai, (K. R. Wood, pers. comm., 1997).

Conservation status and threats. The major threats to *Hedyotis flynnii* are browsing and the resulting erosion, habitat degradation, and landslides provoked by the large feral goat populations in Kalalau Valley and adjacent areas on the Na Pali coast. Feral pigs are also a threat in some areas. In addition, invasion by numerous alien plant species, primarily *Erigeron karvinskianus* DC., *Kalanchöe pinnata* (Lamarck) Persoon, *Psidium guajava* L., *Schinus terebinthifolius* Raddi, *Lonicera japonica* Thunberg, *Passiflora mollissima* (Kunth) L. H. Bailey, *Rubus argutus* Link, and *Lantana camara* L., also threatens this species.

Morphology. Collections from lower elevations, i.e., from Limahuli and Hanakapiai Valleys, tend to have truncate to broadly rounded leaf bases, whereas those from higher elevations in localities to the west are characterized by having obtuse to cuneate bases.

Paratypes. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Hanalei District: Limahuli Valley, on exposed rock face on ridge extending into valley on W side, N exposure, 1200 ft. (366 m), 16 Dec. 1985, *Flynn & Bergau 1442* (PTBG); Limahuli Valley, E side of valley near Pohaku Kane, NE-facing cliff, 1400 ft. (427 m), 17 Oct. 1996, *Perlman & Wichman 15631* (BISH, PTBG, US); Hanakapiai Valley, W side of valley, cliffs below Pohakea, 1150 ft. (350 m), 27 June 1996, *Perlman 15448* (BISH, PTBG, US, WU); Na Pali Kona Forest Reserve, Kalalau valley, below Pu'u O Kila Lookout, 3400 ft. (1067 m), 23 Sep. 1989, *Montgomery s.n.* (BISH); Kalalau rim, Kalahu, cliff, 1 Feb. 1950, *Degener & Hatheway 24353* (BISH, US); Kalalau Valley, W side of valley N of Pu'u O Kila lookout, 3200 ft. (975 m), 5 Oct. 1994, *Perlman & Wood 14451* (PTBG, WU); Kalalau, drainage W of Pu'u O Kila, *Exocarpus* ridge, 3000 ft., 22 May 1991, *Wood & Sloan 876* (PTBG); Kalalau rim, NE below Pu'u O Kila and down to peach tree ridge, 1100–1200 m, 9 Oct. 1991, *Wood et al. 800* (PTBG), *Wood et al. 810* (PTBG, US); Kalalau rim, N, below Pu'u O Kila, 1030 m, 5 Aug. 1991, *Wood et al. 1090* (PTBG); Kalalau Valley, in back of valley, 750–800 m, 11 June 1992, *Wood et al. 1967* (PTBG); Kalalau rim, N of Kahuama'a Flat, 990–1020 m, 3 Mar. 1991, *Wood et al. 627* (BISH, PTBG), 4 Dec. 1991, 800 m, *Wood & Query 1018* (PTBG, US); S rim of Kalalau Valley, N of Kahuama'a Flat and Hwy. 550, 900 m, 6 Mar. 1991, *Lorence et al. 6718* (GH, PTBG, US), *Wood 638* (PTBG); Kalalau rim, Kalahu side below and W of first Kalalau look-

out, 950 m, 3 Sep. 1991, *Wood 1185* (PTBG), 790 m, 20 Sep. 1991, *Wood 1400* (PTBG), 700–800 m, 22 Nov. 1991, *Wood 1418* (PTBG, US), 550–670 m, 4 Dec. 1991, *Wood 1460* (PTBG, US), 900–1000 m, 20 Aug. 1991, *Wood 1158* (PTBG), 2150–2350 ft., 14 Oct. 1994, *Wood 3641* (PTBG), 1900–2100 ft. (579–640 m), 27 Feb. 1994, *Wood & Perlman 3021* (PTBG); Kalalau Valley, slopes of Kalahu, 300 m E of Navy plane crash, 2500 ft. (762 m), 2 Aug. 1994, *Wood & Perlman 3387* (GH, K, MO, PTBG); Kalalau rim, N–S-running ridge below and E of first Kalalau lookout, 960–1100 m, 18 Sep. 1991, *Wood 1240* (BISH, PTBG, US[2]), *Wood 1243* (PTBG); Honopu [Valley] rim, N-facing cliffs, 500 m W of easternmost rim, 750–850 m, 5 Sep. 1991, *Wood et al. 1204* (US); Honopu [Valley] rim, 3000 ft. (914 m), 6 Nov. 1993, *Wood 2824* (PTBG), 2800 ft. (853 m), *Wood 2829* (BISH, PTBG, US); Pohakuao, hanging valley between Kalalau and Hanakoa, 400–600 m, 1 Apr. 1992, *Wood 1762* (PTBG), 600 m, 2 Apr. 1992, Pohakuao, cliffs below Pu'u Ki and Manoa Ridge, 2020 ft. (613 m), 2 Apr. 1992, *Perlman et al. 12692* (PTBG). Waimea District: Awa'awapuhi Valley, N-facing slopes above stream, 0.5 mi. in along trail, 3300–3500 ft. (1006–1067 m), 18 May 1994, *Wood et al. 3197* (K, PTBG, US), 3480 ft. 18 May 1994, *Perlman & Wood 14201* (PTBG, US). Nualolo Valley, 2800–3100 ft., 18 Dec. 1994, *Wood 3857* (CHR, PTBG). Kawaiula Valley, 2700–3300 ft., 5 Feb. 1994, *Wood & Lau 3695* (PTBG).

Affinities. *Hedyotis flynnii* keys out to *H. parvula* (A. Gray) Fosberg following the key in Wagner et al. (1990) and may be most closely allied to it, although the similarities may represent convergent adaptations to the cliff habitat. A more biogeographically parsimonious hypothesis is that both *H. flynnii* and *H. parvula* were derived from the polymorphic and widespread *H. schlechtendahliana* Steudel. This hypothesis is supported in that features of *H. flynnii* and *H. parvula* that are most similar are ones expected in an exposed cliff habitat, such as reduced leaf size and internode length and coriaceous blade texture. However, *H. flynnii* and *H. parvula* are quite distinct in floral morphology. Flowers of *H. parvula* are pure white or white tinted with pink or purple-pink or violet, whereas corollas of *H. flynnii* have a yellowish green or green tube and white to yellowish or greenish yellow lobes. The corolla tube: lobe length ratio in both staminate and pistillate flowers is somewhat greater in *H. flynnii*, 2:1 to 4.5:1 (rarely 1.6:1), with no difference between the sexes, compared to 1.6:1 to 1.8:1 in *H. parvula.*

Breeding system. Our study of the available collections suggests that *Hedyotis flynnii* has a dioecious breeding system. This is based on the morphology described above and microscopic examination of anthers and pollen from six collections. Staminate (larger) flowers have large anthers, which produce conspicuous and abundant, well-developed pollen grains and have poorly developed, coherent, apparently non-functioning stigma lobes. The ovules, although present at the flowering stage, do not develop. All but two of these collections had no developed capsules, providing further confirmation that they had staminate rather than perfect flowers. However, two otherwise normal staminate collections each had a single, abnormally small capsule (*Wood 1240, Wood 1418*). Seed production was not evident, as one capsule had dehisced and the other contained an insect pupa. Pistillate flowers, on the other hand, always display tiny, aborted stamens with no evidence of pollen development, whereas the stigma lobes were well developed and divergent. There is a similar pattern of style morphology in another Hawaiian species, *H. tryblium* Herbst & W. L. Wagner (*H.* sect. *Phyllozygia* W. L. Wagner & Herbst), and this was interpreted by Wagner et al. (1989, 1990) in the same fashion as for *H. flynnii,* but in that case there was not supporting information on ovules and fruit development. In *H. tryblium* functional (short-styled flowers) and non-functional (long-styled flowers) anthers were found. However, the distribution of the different types of flowers was different in *H. tryblium* with at least some of the two types occurring on the same plant, suggesting a gynomonoecious or monoecious breeding system. Another difference was that the larger corollas were found in the apparent pistillate rather than the staminate (or perfect) flowers.

Another intriguing aspect of *Hedyotis flynnii* is the strong corolla size dimorphism, where the staminate flower is much larger than the pistillate. This agrees with the traditional view regarding sexual dimorphism in flower size where corollas on staminate flowers are always or nearly always larger those those on pistillate flowers (Delph, 1996). Delph (1996) has shown, however, that the traditional view stems from numerous temperate examples, but when tropical species are considered female flowers are about as likely to be larger than as smaller than males. In Rubiaceae, many genera and tribes have floral dimorphism, ranging from heterostyly (e.g., *Psychotria, Rondeletia*), to dioecy with non-functional stamens or pistils (e.g., *Randia*), to flowers that are highly differentiated morphologically (e.g., *Coprosma*). The syles of both sexes in *H. flynnii* are similar in length, and it is the corolla dimorphism that gives the appearence of heterostyly. The breeding system of this and related species of Hawaiian *Hedyotis* should provide valuable information on the evolution of breeding systems of Rubiaceae.

Hybridization. Two collections representing probable hybrids between *H. flynnii* and *H. schlechtendahliana* subsp. *schlechtendahliana* are

known from a population in Pohakuao Valley, where these two taxa grow sympatrically.

Specimens examined. HAWAIIAN ISLANDS (U.S.A.). Kaua'i: Hanalei District, Pohakuao, hanging valley between Kalalau and Hanakoa, 600 m, collected below Pu'u Ki, NW aspect, 2 Apr. 1992, *Wood et al. 1762* (PTBG) [this specimen is closer to *H. flynnii*], *Wood et al. 1766* (PTBG, US) [this collection was growing sympatrically with *H. flynnii*, but is closer to *H. schlechtendahliana*].

Etymology. We take particular pleasure in naming this attractive new species in honor of Timothy W. Flynn, Curator of the National Tropical Botanical Garden herbarium (PTBG), who has made extensive collections over nearly 20 years, especially of Kaua'i plants, contributing much new knowledge of the Hawaiian flora, and who has provided both of us with many new and significant insights.

Reevaluation of *Hedyotis schlechtendahliana* on Kaua'i

In the most recent treatment of Hawaiian *Hedyotis* by Wagner et al. (1990) both *Hedyotis glaucifolia* (A. Gray) Fosberg of Kaua'i and the O'ahu plants treated as *H. angusta* Fosberg were included in the polymorphic *H. schlechtendahliana.* Wagner et al. further stated that although these two subsumed taxa represented distinctive forms their most striking features, and those used to separate these taxa, appeared to vary independently and thus formed a continuum of variation rather than defining discrete taxa. Fosberg (1943), in his revision of the genus in the Pacific region, stated in several places that the differences among these and a number of other Hawaiian *Hedyotis* were "rather intangible" and that often the most distinctive features intergrade the most. Numerous new collections made on the island of Kaua'i since the Wagner et al. (1990) treatment have allowed us to reevaluate the taxonomy of this complex species. Our studies revealed that although there is considerable intergradation on Kaua'i between the widespread morphological form of *H. schlechtendahliana,* which occurs on Kaua'i, O'ahu, Moloka'i, Lana'i, and Maui, and the plants treated by Fosberg as *H. glaucifolia,* there are several correlated characters that delimit a taxon occurring in northern Kaua'i, which geographically overlaps only slightly with the widespread taxon, *H. schlechtendahliana* subsp. *schlechtendahliana.* Because of the intergradation we here adopt a taxonomy recognizing this entity as a subspecies of *H. schlechtendahliana.* The three recognized subspecies of *H. schlechtendahliana* can be separated by the following key. We have included nomenclature of *H. schlechtendahliana* subsp. *remyi* because a lectotypification was necessary to stabilize the name as it has been used since Fosberg's revision, and to call attention to current distribution information on this endangered taxon. We have not given full nomenclature for *H. schlechtendahliana,* but only those names with types from Kaua'i.

Key to the Subspecies of *Hedyotis schlechtendahliana*

1a. Leaves cordate, 3–6 cm long, the margin conspicuously revolute; inflorescences narrow, 2–3 nodes long; corollas cream-colored; Lana'i . . . . . subsp. *remyi*

1b. Leaves variously shaped, the base cuneate to truncate, occasionally cordate, usually over 5 cm long, the margins flat or very slightly revolute; inflorescences broad, usually more than 3 nodes long; corollas pale green to greenish yellow or greenish white; Kaua'i, O'ahu, Moloka'i, Maui.

2a. Leaves membranaceous to coriaceous, the lateral veins conspicuous, the tertiary venation inconspicuously reticulate; inflorescence axes elongate, the upper ones short; flowers produced in congested cymes, these sometimes elongating monochasially; bracts and calyx lobes usually foliaceous, the bracts usually partly obscuring the flowers; corolla pale green to greenish yellow; northern to eastern Kaua'i . . . . . subsp. *schlechtendahliana*

2b. Leaves stiffly chartaceous to coriaceous, lateral and tertiary venation equally prominent, the tertiary venation conspicuously reticulate; inflorescence axes spreading and elongate throughout, usually not elongating monochasially; bracts and calyx lobes not foliaceous, usually slender, subulate, not obscuring the flowers; corolla pale green to greenish yellow or greenish white; northwestern Kaua'i . . . . . subsp. *waimeae*

Hedyotis schlechtendahliana subsp. **remyi** (Hillebrand) Fosberg, Bernice P. Bishop Mus. Bull. 174: 40. 1943. *Kadua remyi* Hillebrand, Fl. Hawaiian Isl. 162. 1888. *Hedyotis schlechtendahliana* Steudel var. *remyi* (Hillebrand) Fosberg, Bernice P. Bishop Mus. Bull. 174: 40. 1943. *Hedyotis remyi* (Hillebrand) Fosberg, Brittonia 8: 165. 1956. TYPE: Hawaiian Islands.. Lana'i: on highest ridge, 1870, *W. Hillebrand s.n.* (lectotype, here designated, US-809302; isolectotypes, B, E, K, none seen). Fosberg mentioned this collection as the "type" in 1943, and we assume he selected the B sheet (now destroyed) effectively as the lectotype; he annotated the US collection here selected as lectotype as "isotype?". Because the B sheet is no longer extant we here select the US sheet of the Lana'i collection as the

replacement lectotype. The additional syntype, "Hamakua, East Maui" collected by J. Lydgate (photo of B sheet at BISH and BISH [with label by C. N. Forbes giving collectors as Hillebrand and Lydgate]), which is a collection of *H. schlechtendahliana* subsp. *schlechtendahliana*, was clearly segregated by Fosberg from his circumscription of *Hedyotis schlechtendahliana* subsp. *remyi*.

Distribution and habitat. *Hedyotis schlechtendahliana* subsp. *remyi* was historically known from several locations on the northwestern portion of Lanaihale, Lana'i, but currently because of habitat loss and degradation it is known from only six individuals from Kaiholeha-Hulupoe Ridge (Bruegmann, 1997) and therefore proposed for United States Endangered status. It occurs in mesic windswept shrubland habitat.

Hedyotis schlechtendahliana subsp. **waimeae** (Wawra) W. L. Wagner & Lorence, comb. et stat. nov. Basionym: *Kadua waimeae* Wawra, Flora 57: 264. 1874. *Hedyotis glaucifolia* (A. Gray) Fosberg var. *waimeae* (Wawra) Fosberg, Bernice P. Bishop Mus. Bull. 174: 43. 1943. TYPE: Hawaiian Islands. Kaua'i: Halemanu woods, 1869–1870, *H. Wawra 2087* (holotype, W not seen).

Kadua glaucifolia A. Gray, Proc. Amer. Acad. Arts 4: 318. 1859. *Hedyotis glaucifolia* (A. Gray) Fosberg, Bernice P. Bishop Mus. Bull. 174: 41. 1943. TYPE: Hawaiian Islands. Kaua'i: 1840, *U. S. Expl. Exped. s.n.* (holotype, US-42370; isotype, GH not seen).

Hedyotis glaucifolia (A. Gray) Fosberg f. *nealae* Fosberg, Bernice P. Bishop Mus. Bull. 174: 43. 1943. TYPE: Hawaiian Islands. Kaua'i: Halemanu, 3600 ft., 30 Apr. 1929, *M. C. Neal s.n.* (holotype, BISH-511673).

Hedyotis glaucifolia (A. Gray) Fosberg var. *subimpressa* Fosberg, Brittonia 8: 166. 1956. TYPE: Hawaiian Islands. Kaua'i: along road to Mohihi River, just NW of Kawaikoi Stream, steep grass and *Dicranopteris* slope, 13 Jan. 1952, *O. Degener & A. Greenwell 21746* (holotype, US-2062361; isotype, BISH).

Distribution and habitat. *Hedyotis schlechtendahliana* subsp. *waimeae* is restricted to central western Kaua'i west of the Alaka'i Plateau from the Koke'e area, Nualolo and Awa'awapuhi Valleys in the north to Kauhau Ridge, Mahanaloa and Makaha Valleys, and the more distant Hanapepe Valley in the south. It occurs in diverse mesic forest often with *Acacia koa*, *Metrosideros polymorpha*, and *Alphitonia ponderosa* dominant at elevations from 750 to 1220 m. This subspecies is known to overlap and intergrade with subspecies *schlechtendahliana* in Waimea and Koloa districts in the area bounded by and including the Nualolo Valley, areas in the vicinity of Mohihi and Kumuela, upper Koai'e Canyon, and Hanapepe Valley.

Representative specimens. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Koloa District: [Hanapepe Valley], opposite Gay and Robinson's house, *A. A. Heller 2615* (NY); along the Hanapepe River, near the falls, 24–26 June 1895, *Heller 2442* (BISH, US); Waimea District: upper Nualolo Stream, N branch, 3700–3800 ft., 23 Nov. 1995, *Wood & Davis 4793* (PTBG); Kuia Natural Area Reserve, Nuololo, 3650–3920 ft., 17 Aug. 1993, *Wood & Perlman 2707* (PTBG); Kuia Natural Area Reserve, Kaunuohua Ridge W of and below Hwy. 550, 3560 ft., 15 Feb. 1989, *Flynn & Kawakami 3271* (BISH, PTBG, US); upper Kuia Valley, 3000–3200 ft., 6 Nov. 1994, *Wood & Lau 3702* (PTBG); Kuia Natural Area Reserve, Mahanaloa Valley, valley N of Milolii Ridge, above confluence with Paaiki Valley, 868–750 m, 22 Dec. 1994, *Lorence & Wood 7618* (BISH, PTBG, US); upper NE gulch of Makaha Valley, 2800–3000 ft., 8 Nov. 1994, *Wood 3742* (PTBG); Koke'e [State Park], Dec. 1960, *Degener 27226 (Coll. H. Hansen)* (BISH); Koke'e [State Park], E of Kumuweia Ridge, 3500 ft., *Degener 20491* (BISH, US); Koke'e State Park, in Awa'awapuhi trail just W of Hwy. 550, 1220 m, 2 Jan. 1989, *Lorence et al. 6321* (PTBG, US); Koke'e [State Park], 4000 ft., 22 Mar. 1972, *Herbst 2375* (BISH, PTBG); Kalalau trail, above Koke'e, 1150 m, Dec. 1935, *Fosberg 12718* (BISH, US); Makaha Valley, 0.9 mi. down Makaha Ridge road from Hwy. 550, 3180 ft., 31 July 1985, *Flynn 1158* (BISH, PTBG); Koke'e State Park, unnamed trail from Koke'e–Halemanu Trail to Highway 550, 1080–1100 m, 17 Feb. 1988, *Lorence et al. 5809* (PTBG); Koke'e State Park, along Elekeninui Strm., near crossing with Mohihi jeep tr., 1100 m, 25 May 1976, *Fay 594* (PTBG); Koke'e, Mohihi road 0.2 mi. W of Kumuwela Road, 3660 ft., 4 Mar. 1986, *Flynn 1584* (BISH, PTBG); Waiakoali, Aug. 1930, *Neal s.n.* (BISH); Kopakaka Ridge, 2900 ft., 23 Jan 1986, *Flynn & Lopez 1466* (BISH, PTBG); Waimea drainage basin, W side, Aug. 1917, *Forbes 802.K* (BISH, US), 3 July to 18 Aug., *Forbes 805.K* (BISH); Kaholuamamu, behind Waimea, Sep. 1909, *Forbes 385.K* (BISH), *Rock 5787 (145)* (BISH), 3–10 Mar. 1909, *Rock 1942(143)* (BISH); Halemanu, 14–26 Feb. 1909, *Rock 1887* (BISH), *Rock 1886 (143)* (US); Kauhau Ridge, near gauging station and ditch, 3220 ft., Wai'alae Valley, ridge between Wai'alae and Nawaimaka Valleys, above Wai'alae Falls, 950–1050 m, 16 Apr. 1991, *Wood et al. 852* (MO, PTBG, US); Koai'e Canyon, upper reaches of canyon, 2950–3080 ft., 31 Aug. 1994, *Wood & Perlman 3464* (BISH, US); Kauhau Ridge, near gauging station and ditch, 3100 ft., 12 July 1993, *Wood 2668* (US), 3220 ft. 3 Nov. 1994, *Wood 3478* (US), 3 Sep. 1994, *Wood 3482* (BISH, MO, NY, PTBG, US, WU), *Wood 3486* (US).

Hedyotis schlechtendahliana subsp. **schlechtendahliana** (on Kaua'i)

Kadua cordata Chamisso & Schlechtendal var. *pruinosa* Wawra, Flora 57: 262. 1874. *Kadua cordata* Chamisso & Schlechtendal var. *laxa* Hillebrand, Fl. Hawaiian Isl. 161. 1888, nom. superfl. TYPE: Hawaiian Islands. Kaua'i: Wai'ale'ale Plateau, 1869–1870, *H. Wawra 2202* (holotype, W not seen). Fosberg (Bernice P. Bishop Mus. Bull. 174: 38. 1943) selected the collection from Kaua'i, high plateau, s.d., *V. Knudsen s.n.* (B presumably destroyed) as the type of the Hil-

lebrand name, but because Hillebrand included Wawra's name, which Fosberg did not note, with his new taxon it is superfluous and automatically typified on the Wawra collection.

Kadua cordata Chamisso & Schlechtendal var. *opaca* Wawra, Flora 57: 262. 1874. *Hedyotis schlechtendahliana* Steudel var. *opaca* (Wawra) Fosberg, Bernice P. Bishop Mus. Bull. 174: 38. 1943. TYPE: Hawaiian Islands. Kaua'i: Pohakupili, 1869–1870, *H. Wawra 2041* (holotype, W not seen).

Distribution and habitat. *Hedyotis schlechtendahliana* subsp. *schlechtendahliana* is known from the northern to eastern parts of Kaua'i from the Koai'e Canyon and Nualolo Valley to Kalalau Valley around to Hanalei Valley, and also Mt. Haupu, the Wahiawa Mountains, and the ridges surrounding Hanapepe River Valley at elevations ranging from (360–)650 to 1200 m. It ranges from diverse mesic forest with taxa such as *Bobea, Metrosideros, Pleomele,* and *Perrottetia* to wet *Metrosideros–Dicranopteris* forest with taxa such as *Ilex, Melicope, Tetraplasandra, Psychtoria,* and *Syzygium.*

Representative specimens from Kaua'i. Hanalei District: Upper Hanalei Valley, back of valley below Pohakupele, 2300 ft., 22 Mar. 1993, *Perlman et al. 13462* (PTBG); Pu'u Ka Ele Strm. (Kilauea), Oct. 1916, *Forbes 566.K* (BISH); Wainiha Valley, back of valley on left (N side) fork, 2500 ft., 29 Jan. 1993, *Perlman et al. 13288* (PTBG); Namolokama plateau, steep slope on W side, 1265 m, 18 June 1991, *Hobdy et al. 3324* (BISH [2]); Na Pali Coast State Park, survey transect 4, Sta. 7.0, Hanakoa valley, on E side of Hanakoa Falls plunge pool, 1200 ft., 6 June 1989, *Perlman et al. 10358* (PTBG, US); Kalalau rim, Kalahu side below and W of first Kalalau lookout, 790 m, 13 Mar. 1992, *Wood & Perlman 1711* (AD, MO, PTBG, US); Pohakuao, cliffs above Kalalau tr., 14 June 1989, *Hobdy et al. 3060* (BISH), 600 ft., *Perlman et al. 10377* (US); upper Honopu drainage (N side), 3550–3700 ft., 28 Jan. 1996, *Wood 4936* (AD, MO, PTBG, US, WU). Waimea District: Nuololu, Kuia Natural Area Reserve, 3650–3920 ft., 17 Aug. 1993, *Wood & Perlman 2708* (PTBG); Koke'e State Park, Kauaikinana Stream below dam on Mohihi Road, 3400 ft., 10 July 1985, *Flynn 1142* (PTBG); Koke'e Strm., 30 June 1926, *Degener 30456* (BISH); Po'omau Canyon and northern ridge dropping into Po'omau, 900–950 m, 11 Oct. 1991, *Wood 1274* (PTBG); Waimea drainage basin, W side, 3 Jul. to 18 Aug. 1917, *Forbes 848.K* (BISH); Koai'e Canyon, upper reaches of canyon, 2950–3080 ft., 31 Aug. 1994, *Wood & Perlman 3472* (PTBG). Koloa District: Lihue-Koloa Forest Reserve, Wahiawa Mountains just NE of Wahiawa Bog, along N fork of Wahiawa Stream, NW of Mt. Kahili, 650–710 m, 7 Apr. 1988, *Lorence et al. 5934* (BISH, PTBG, US[2]); first N fork of Wahiawa Strm., 650–720 m, Apr. 1988, *Wagner & Imada 6013* (BISH, US); ridge W of the Hanapepe River, 22 Aug. 1895, *Heller 2615* (US). Lihu'e District: Ha'upu Range, Mar. 1909, *Rock 2454* (BISH), 700 m, Feb. 1927, *MacDaniels 869* (BISH), *MacDaniels 716* (BISH), 31 Dec. 1956, *St. John 26036* (BISH, US).

The following specimens from a limited area on Koke'e plateau where the two subspecies are sympatric are intermediate between *Hedyotis schlechtendahliana* subsp. *schlechtendahliana* and subspecies *waimeae.* These collections would be difficult to assign to either of the two Kaua'i subspecies. Other collections from the area of general sympatry are also somewhat intermediate, but are more similar to one of the subspecies, especially those assigned to subspecies *waimeae.* These collections exhibit broadly ovate and often cordate leaves, but have open inflorescences and conspicuous venation.

Hedyotis glaucifolia (A. Gray) Fosberg var. *helleri* Fosberg, Bernice P. Bishop Mus. Bull. 174: 44. 1943. TYPE: Koke'e Strm., June 1926, *Degener 11653* (lectotype, here designated, BISH-504151; isolectotype, BISH). Four syntype collections (all besides the lectotype represent *Hedyotis schlechtendahliana* subsp. *waimeae*) were cited from Kaua'i, the additional syntypes being: Kaua'i [Hanapepe Valley], opposite Gay and Robinson's house, *A. A. Heller 2615*; Kaholuamanu, *Rock 93,* and *Rock 1936.* There is at least one other collection made by Heller given this same distribution number of 2615, but collected at a somewhat different locality.

Additional intermediate specimens. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Waimea District: Koai'e Canyon, 0.75 mi. up stream, 2000 ft., 16 Apr. 1991, *Wood et al. 741* (PTBG); Koholuamanu, Sep. 1909, *Forbes s.n.* (BISH); head of Kumuwela Ridge, 28 Dec 1935, *Fosberg 12668* (BISH, US).

Acknowledgments. We thank Anna Asquith for preparing the illustration and the curator of BISH for the loan of specimens. Kenneth R. Wood and Timothy W. Flynn provided valuable field observations. We appreciate comments by Robynn Shannon, which contributed to the clarity of this paper.

Literature Cited

Bruegmann, M. 1997. Endangered and threatened wildlife and plants; Proposed endangered status for 10 plant taxa from Maui Nui, Hawaii. Fed. Reg. 62(94): 26757–26770.

Delph, L. F. 1996. Flower size dimorphism in plants with unisexual flowers. Pp. 217–237 *in* D. G. Lloyd & S. C. H. Barrett (editors), Floral Biology: Studies on Floral Evolution in Animal-pollinated Plants. Chapman & Hall, New York.

Fosberg, F. R. 1943. The Polynesian species of *Hedyotis* (Rubiaceae). Bernice P. Bishop Mus. Bull. 174: 1–102.

Wagner, W. L., D. R. Herbst & S. H. Sohmer. 1989. Contributions to the Flora of Hawai'i. II. Begoniaceae–Violaceae and the Monocotyledons. Bishop Museum Occas. Pap. 29: 88–130.

———, ——— & ———. 1990. Manual of the Flowering Plants of Hawai'i. 2 vols. Univ. Hawaii Press, Bishop Museum Press, Honolulu.

A New Species of *Wikstroemia* (Thymelaeaceae) from Hiva Oa, Marquesas Islands

Warren L. Wagner
Department of Botany, MRC-166, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.
Email: wagner.warren@nmnh.si.edu

David H. Lorence
National Tropical Botanical Garden, P.O. Box 340, Lawai, Hawaii 96765, U.S.A.
Email: lorence@ntbg.org

ABSTRACT. A new species, *Wikstroemia johnplewsii,* is described and illustrated. This distinctive species is restricted to upper montane mesic to wet forest on the island of Hiva Oa (Marquesas Islands in French Polynesia); it differs from the only other *Wikstroemia* species in the Marquesas, *W. coriacea,* which occurs widely in Polynesia, by its ovate-elliptic to suborbicular, subsessile leaves and long, 9–27-flowered, racemose inflorescences with an elongate peduncle and inflorescence axis.

In his treatment of *Wikstroemia* Endlicher for the *Flora of Southeastern Polynesia,* Brown (1935: 190–191) recognized but a single species in the Marquesas Islands, the common and widespread Polynesian *W. foetida* (L. f.) A. Gray. He noted the occurrence of two forms: a "short-pedunculate form" widespread and known from four of the Marquesas Islands (Nuku Hiva, Ua Pou, Hiva Oa, and Fatu Hiva), and a "long-pedunculate form" known only from Hiva Oa. Brown, however, did not give formal taxonomic recognition to either of these forms.

Intensive botanical exploration of the Marquesas, which began in the 1970s, has produced numerous new collections, including a distinctive species of *Wikstroemia,* which differs from the above species in its ovate-elliptic to suborbicular, subsessile leaves and long, racemose, 9–27-flowered inflorescence with a long peduncle and inflorescence axis. This new species, described below, obviously corresponds to Brown's "long-pedunculate form" of *W. foetida.* The widespread Polynesian species by contrast has elliptic, occasionally oblanceolate or obovate, petiolate leaves, short racemose, usually less than 8-flowered inflorescences and with a short or long peduncle, but always a short inflorescence axis.

According to Fosberg (1993: 68), *Wikstroemia coriacea* Seemann is the correct name for the common Polynesian species, long known as *Wikstroemia foetida,* because the type of the basionym, *Daphne foetida* L. f., represents a species of *Ixora* (Rubiaceae) now known as *Ixora foetida* (L. f.) Fosberg. The only other *Wikstroemia* species known from French Polynesia is *W. raiateensis* J. W. Moore (Moore, 1933), a prostrate shrub that has not been collected in the Marquesas Islands.

Wikstroemia johnplewsii W. L. Wagner & Lorence, sp. nov. TYPE: Marquesas Islands. Hiva Oa: trail from Feani to Atuona, 960 m, 13 Feb. 1975, *R. L. Oliver & P. A. Schäfer 3162* (holotype, US; isotypes, BISH, K, P, PTBG). Figure 1.

Differt a *Wikstroemia coriacea* inflorescentia longiora racemosa, floribus 9–27, pedunculo 12–32(–40) mm longo, rhachidi (8–)25–40 mm longa.

Shrubs, 0.7–2(–4.5) m tall, many-branched, often divaricately, glabrous throughout, bark on young stems dark reddish brown, becoming increasingly fissured and grayish brown, young twigs conspicuously compressed, costate to narrowly winged. Leaves coriaceous, chartaceous when dry, upper surface glossy green, the lower surface paler green than upper surface and dull, ovate-elliptic to broadly ovate, elliptic or suborbicular, 3.2–8 × 2.5–5.5 cm, those subtending the inflorescence 2.5–7.5 × 2–3.7 cm, apex rounded to short-acuminate, sometimes bluntly so, or occasionally retuse (perhaps by injury), base broadly cuneate to truncate or weakly cordate, petioles 1.5–2 mm long. Inflorescence an elongate raceme, glabrous throughout, the peduncle 12–32(–40) mm long, the flowering axis (8–)20–40 mm long, pedicels ca. 1 mm long in flower, up to 4 mm long in fruit. Flowers

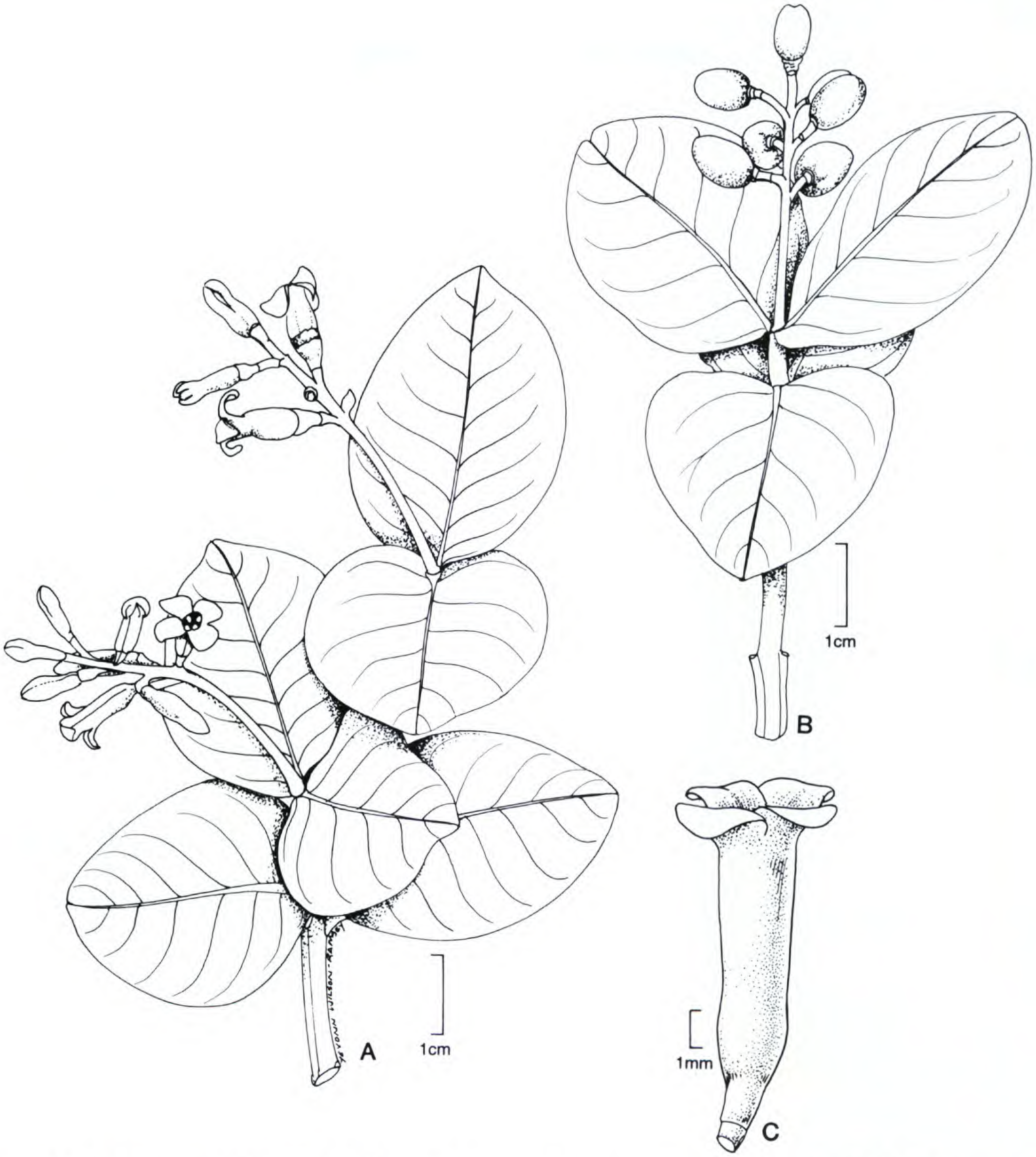


Figure 1. *Wikstroemia johnplewsii* W. L. Wagner & Lorence, drawn primarily from slides taken by W. L. Wagner and from *Sachet & Decker 1150.* —A. Flowering branch. —B. Fruiting branch. —C. Calyx.

(9–)12–27 or perhaps more, perfect; calyx tubular, greenish yellow, glabrous, slightly tapered toward the base, the tube 7–8 mm long, the lobes dimorphic, the shorter pair ca. 1.5 × 1.5 mm, triangular-ovate, apparently slightly cupped, the longer pair ca. 2.5–3 × 1.5–3 mm long, asymmetrically ovate; nectary scales ca. 0.8 mm long, linear, nearly distinct to the base; stamens with the lower whorl included, inserted near midway in the tube, and the upper ones with the anther apex flush with the apex of the calyx tube; anthers ca. 1 mm long; filaments ca. 0.5 mm long; ovary cylindrical, ca. 1.5–2 mm long, sparsely pilose apically; stigma reddish purple, subcapitate, papillate. Fruit (immature?) 8–9 mm long, ca. 5 mm diam. (when dry), fleshy, ellipsoid-ovoid, greenish orange.

Distribution, habitat, and ecology. *Wikstroemia johnplewsii* is endemic to the island of Hiva Oa, Marquesas Islands, occurring in mesic to wet forest, sometimes in grassy woodlands of mostly introduced species, and occasionally near roadcuts, at

elevations from 700 to 1130 m. Commonly associated species are *Metrosideros collina* (J. R. Forster & G. Forster) A. Gray, *Weinmannia parviflora* G. Forster, *Crossostylis biflora* J. R. Forster & G. Forster, *Psychotria, Ascarina marquesensis* A. C. Smith, *Freycinetia, Hibiscus tiliaceus* L., *Pandanus* sp., *Reynoldsia marchionensis* F. Brown, *Cheirodendron bastardianum* (Decaisne) Frodin, *Lycopodium cernuum* L., *Cyathea, Dicranopteris linearis* (Burman f.) Underwood, *Cyrtandra,* and *Scaevola.* When occurring primarily with introduced vegetation it grows with various species of grasses and *Psidium.*

Paratypes. MARQUESAS ISLANDS. **Hiva Oa:** road from Atuona to Puamau, just below Mt. Ootua, 625–700 m, 23 Nov. 1974, *Sachet & Decker 1906* (BISH, US), 700 m, 22 Jan. 1975, *Sachet et al. 2132* (US); Mt. Ootua, old trail E of summit, 640 m, 26 Feb. 1975, *Oliver & Schäfer 3217* (BISH, P, PTBG, US); central part, Mt. Ootua, 800 m, 27 July 1977, *Gagné 1167* (BISH, US); chemin d'Atuona à Hanamenu par Feani, pente vers Hanamenu, 1000 m, 12 fév. 1975, *Schäfer 5201* (BISH, PTBG, US); trail to Feani and Hanamenu, ca. 1 mi. above spring and camp, 3700 ft. (1130 m), 30 July 1988, *Perlman 10192* (BISH, F, MO, P, PAP, PTBG, US); trail toward Hanamenu, 3200 ft., 3 Aug. 1988, *Perlman 10199* (AD, BISH, E, F, K, MO, P, PAP, PTBG, US), *Perlman 10202* (BISH, MO, P, PAP, PTBG, US); where trail toward Hanamenu turns into dry ridge, 3000 ft., 3 Aug. 1988, *Perlman 10216* (BISH, MO, P, PAP, PTBG, US); Mont Ootua, bord de l'ancien chemin, à l'est du mont, 730 m, 26 fév. 1975, *Schäfer & Oliver 5254* (US); Mt. Ootua, off road between airport and Puamau, along ridge and summit, 841–865 m, 21 Aug. 1995, *Perlman & Wood 14864* (AD, BISH, MO, P, PAP, PTBG, US); Atuona–Feani Trail, crest of ridge and top of leeward slope, 1200–1300 m, 24–26 Sep. 1963, *Sachet & Decker 1150* (BISH, PAP, US); mts. NW du Temetiu, crête au SE du campement, N de la haute vallée de Hanamenu, 840 m, 22 oct. 1975, *Schäfer 5909* (US); Vaipahee Falls area, ridge crest, Kaava ridge further toward Feani, 3000 ft., 9 Aug. 1988, *Perlman 10249* (BISH, PTBG, US); Vaina, 700 m, June 1929, *Mumford & Adamson 430* (BISH).

Etymology. It gives us great pleasure to name this new species for NTBG trustee John Harry Rice Plews, steadfast supporter of the Garden's research program, who was a major financial contributor to the 1988 Fatu Hiva Expedition to the Marquesas Islands, a collaborative expedition between the National Tropical Botanical Garden, Smithsonian Institution, Bernice P. Bishop Museum, and ORSTOM (Papeete).

Acknowledgments. We thank the curator of BISH herbarium for use of facilities and access to specimens. We thank Yevonn Wilson-Ramsey for expertly rendering the illustration with funds provided by the Smithsonian Institution Walcott Fund, and Alice Tangerini for providing the calyx inset. We also appreciate the valuable comments on a draft by Robynn Shannon.

Literature Cited

Brown, F. B. H. 1935. Flora of southeastern Polynesia. III. Dicotyledons. Bernice P. Bishop Mus. Bull. 130: 1–386.

Fosberg, F. R. 1993. The Forster Pacific Islands collections from Captain Cook's *Resolution* Voyage. Allertonia 7: 41–86.

Moore, J. W. 1933. New and critical plants from Raiatea. Bernice P. Bishop Mus. Bull. 102: 1–53.

Generic Evaluation of *Boleum*, *Euzomodendron*, and *Vella* (Brassicaceae)

Suzanne I. Warwick
Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, Biological Resources Program, Central Experimental Farm, Ottawa, Ontario K1A OC6, Canada

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Morphological, cytological, and molecular data support the reduction of *Boleum* Desvaux and *Euzomodendron* Cosson to synonymy of *Vella* L. The new combination *Vella bourgaeana* is proposed. A key to the species of *Vella* is presented.

Boleum and *Euzomodendron* have generally been recognized as monotypic Spanish genera, and *B. asperum* (Persoon) Desvaux was originally described as *Vella aspera* Persoon. *Vella*, on the other hand, includes five species distributed in Spain, Morocco, and Algeria. In his comprehensive revision of the tribe Brassiceae, Schulz (1923) placed *Boleum*, *Vella*, *Carrichtera* DC., *Psychine* Desfontaines, *Rytidocarpus* Cosson (as *Distomocarpus* O. E. Schulz), *Schouwia* DC., and *Succowia* Medikus in the subtribe Vellinae, and placed *Euzomodendron*, *Savignya* DC., and *Oudneya* R. Brown in the subtribe Savignyinae. Schulz (1919, 1936) separated these subtribes primarily on the basis of presence vs. absence of the median nectar glands and seed wing: the Vellinae have the median glands and lack the seed wing, whereas the Savignyinae lack the median nectar glands and have the seed wing. Gómez-Campo (1978), however, indicated the presence of vestigial wings in *Boleum* and *Vella* and suggested that *Euzomodendron* should be placed with these two genera in one group. He also suggested (Gómez-Campo, 1980) that the Savignyinae be united with the Vellinae.

Except for the shape of the valvular segment and the presence of a well-developed seed wing, *Euzomodendron* resembles *Vella* and *Boleum* in almost all other morphological characters, especially the woody habit, connation of inner filaments in pairs, and presence of short pedicels, saccate lateral sepals, long petal claws, dark-veined petal blades, seedless flattened beaks, strongly 3- or 5-veined valves, and acutely notched cotyledons (Table 1). In fact, Gómez-Campo (1978) indicated that "the robust valves [of *Euzomodendron*] with narrowed base resemble that of *Vella*," and Gómez-Campo and Tortosa (1974) showed that the cotyledonary notch is indistinguishable in the three genera. However, not only did recent floristic accounts (e.g., Gómez-Campo, 1993; López-González, 1993; Marcos-Samaniego, 1993; Heywood, 1993) maintain the three genera but also placed *Euzomodendron* remotely from *Boleum* and *Vella*. These three genera have been maintained historically because of the taxonomic value placed on the fruit length, fruit dehiscence, and seed wing. In our opinion, the overwhelming similarities in all other characters have been either ignored or given insufficient weight. The connation of the inner filaments into pairs in *Euzomodendron*, *Boleum*, and *Vella* is a remarkable synapomorphy not found elsewhere in the tribe Brassiceae. Several large genera (e.g., *Draba* L., *Arabis* L., and *Erysimum* L.), and even a smaller one such as *Lobularia* Desvaux (4 spp.; Borgen, 1987), include taxa with winged or wingless seeds, whereas *Draba*, *Rorippa* Scopoli, and *Leavenworthia* Torrey, to name just a few, include species with both globose and narrowly oblong to linear fruits (for the many examples, see Rollins, 1993). Therefore, fruit shape and presence of the seed wing often do not warrant the delimitation of genera, especially when used alone.

The similarities between *Boleum* and *Vella* are even stronger than between these and *Euzomodendron*. The "most reliable" characters used to separate the first two are the presence in *Boleum* of short-pedicellate, indehiscent, sessile fruits, and in *Vella* of slightly longer-pedicelled, dehiscent, gynophorate or sessile fruits (Table 1). These characters do not justify the maintenance of these genera. In fact, dehiscent and indehiscent fruits can be found within *Tetracme* Bunge, *Coronopus* Zinn, *Sterigmostemum* M. Bieberstein, and *Ornithocarpa* Rose (or even on the same plant, as in *Diptychocarpus strictus* (DC.) Trautvetter, *Cardamine chen-*

Table 1. Comparison of *Boleum*, *Euzomodendron*, *Vella*, and *Carrichtera*.

Character/trait	*Boleum*	*Euzomodendron*	*Vella*	*Carrichtera*
Chromosome no.	$n = 51$	$n = 17$	$n = 17, 34$	$n = 8, 16$
Duration	perennial	perennial	perennial	annual
Habit	shrub	shrub	shrub	herb
Spines	absent	absent	present or absent	absent
Leaves	entire to few-lobed	pinnatisect or few-lobed	entire, few-lobed, or pinnatisect	1- or 2-pinnatisect
Inflorescence	many-flowered	many-flowered	few- or many-flowered	many-flowered
Flower pedicel	0.3–1(–2) mm	1–3 mm	0.5–2 mm	1–3 mm
Sepals lateral pair	saccate	saccate	saccate	slightly saccate
Petal length	11–16 mm	16–20 mm	(8–)10–20 mm	6–8 mm
Petal claw length	7–11 mm	10–12 mm	(6–)7–15 mm	3–4 mm
Petal blade color/veins	pale yellow/reddish brown	cream/violet	yellow/violet or brown	pale yellow/violet
Filaments of inner stamens	united in pairs	united in pairs	united in pairs	free
Fruit gynophore	absent	absent	absent to 2 mm	absent
Fruit dehiscence	indehiscent	dehiscent	dehiscent	dehiscent
Valve venation	3-veined	3–5-veined	3–5-veined	3-veined
Valve pubescence	hispid	glabrous	hispid to glabrous	hispid
Valvular segment shape	globose or ellipsoid	linear	globose or ellipsoid	ellipsoid
Valvular segment length	3–4 mm	20–35 mm	4–6 mm	3–4 mm
Upper segment shape	lingulate	linear-lanceolate to oblong-triangular	lingulate, ensiform, or cochleariform	cochleariform
Upper segment length	4–7 mm	(3–)5–9(–11) mm	4–12(–15) mm	4–6 mm
Seeds per locule	1	6–8	1 (or 2)	2 or 3
Seed wing	vestigial	well developed	vestigial	absent
Cotyledons	acutely notched	acutely notched	acutely notched	acutely notched
Distribution	NE Spain (4 provinces)	SE Spain (Almeria Prov.)	Spain, Morocco, Algeria	SW Asia E to Iran and Mediterranean

opodiifolia Persoon, and several species of *Aethionema* R. Brown). Similarly, long-gynophorate or sessile fruits can be found in many genera, including *Brassica* L., *Romanschulzia* O. E. Schulz, *Thelypodium* Endlicher, and *Lunaria* L. (Rollins, 1993; Ball, 1993). Therefore, the characters used to distinguish *Boleum* from *Vella* are insufficient to maintain the two genera, and we believe that the two, along with *Euzomodendron*, form a well-defined natural group.

Results from a numerical study based on 32 morphometric characters (Gómez-Campo, 1981) did not support the separation of *Boleum* from *Vella* (*Euzomodendron* was not included in the study). *Boleum asperum* clustered within *Vella* and was closer to *V. anremerica* (Litardière & Maire) Gómez-Campo and *V. mairei* Humbert than the latter two were to *V. spinosa* Boissier and *V. pseudocytisus* L.

Boleum ($n = 51$), *Vella* ($n = 17, 34$), and *Euzomodendron* ($n = 17$) share the same base chromosome number of $x = 17$, which is essentially unique in the tribe Brassiceae, with *Boleum asperum* representing a hexaploid derivative of this complex (Gómez-Campo, 1981; Gómez-Campo & Hinata, 1980; Warwick & Anderson, 1993). The only exception is *Brassica carinata* A. Braun ($n = 17$), the classical allotetraploid species derived from *B. oleracea* L. ($n = 9$) and *B. nigra* (L.) W. D. J. Koch ($n = 8$).

Boleum is restricted to northeastern Spain (Huesca, Lérida, Teruel, and Zaragoza provinces), whereas *Euzomodendron* is endemic to Almería

province in southeastern Spain. In contrast, the range of *Vella* occupies the area between the ranges of *Boleum* and *Euzomodendron* and extends southward into Morocco and adjacent Algeria. This complex occupies a distinct geographical area delimited by eastern and southern Spain into northwestern Africa. On the other hand, the single species of *Carrichtera*, *C. annua* (L.) DC., is a widespread circum-Mediterranean annual weed that extends eastward into Iran (Crespo, 1992; Gómez-Campo, 1993; Greuter et al., 1986; López-González, 1993; Maire, 1967; Marcos-Samaniego, 1993; Warwick & Francis, 1994).

Recent molecular studies of the chloroplast DNA restriction site variation of the three genera (Warwick & Black, 1994) also support the congeneric status of *Boleum*, *Euzomodendron*, and *Vella*. In their strict consensus tree, *V. spinosa*, *B. asperum*, *E. bourgaeanum*, and *Vella anremerica* formed a well-supported clade that was observed in all 28 most parsimonious trees and 100% of the boot-strapping replicates. They showed that the latter clade was defined by 21 steps, compared, for example, to two steps for *Moricandia* and eight steps for *Zilla*. *Carrichtera annua* consistently formed a sister clade to the above four species in all the analyses. Within the *Vella–Boleum–Euzomodendron* clade, *V. anremerica* was placed as the sister group to the clade containing *Vella spinosa*, *Boleum*, and *Euzomodendron* in 21 of the 28 equally most parsimonious trees, whereas *Boleum* formed the sister clade in the seven remaining trees. In all the trees, however, the sister taxon to *Euzomodendron* was a species of *Vella*. These data show that both *Boleum* and *Euzomodendron* are nested within *Vella*. Similar results by Crespo et al. (1998), which are based on sequence data from the internal transcribed spacer region (ITS) of rDNA, indicate that both *Boleum* and *Euzomodendron* fall within *Vella*, with *Carrichtera* forming the sister clade. These molecular studies on totally different genomes provide convincing evidence that supports the reduction of *Boleum* and *Euzomodendron* to synonymy of the earlier published *Vella*.

Crespo et al.'s (1998) analysis of 23 morphological characters separately and in combination with the ITS data were consistent with the placement of *Boleum* with *Vella*. The combined analysis, however, showed *Euzomodendrom* as a sister (basal) clade to that containing *Boleum* and the five *Vella* species (100% boot-strapping replicates), with *Carrichtera* forming the sister clade to the above group. Both molecular (Warwick & Black, 1994; Crespo et al., 1998) and morphological studies (Gómez-Campo, 1981; Crespo et al., 1998) support the inclusion of *Boleum* in *Vella*. Similarly, both molecular data sets (Warwick & Black, 1994; Crespo et al., 1998) support the inclusion of *Euzomodendron* within *Vella*. The basal position of *Euzomodendron* in the combined morphological and molecular analysis of Crespo et al. (1998) is consistent with its more "primitive elongated fruits." However, we believe that the elongated vs. short fruits and well-developed vs. vestigial seed wing do not justify the recognition of *Euzomodendron* as a distinct genus. The unique chromosome number ($x = 17$) and connate filaments, which are resticted in the tribe Brassiceae to the *Boleum–Euzomodendron–Vella* complex, as well as the numerous similarities in morphology and geographic distribution, clearly are in full agreement with molecular data that the complex forms a well-defined genus.

The morphological, geographical, cytological, and molecular data are consistent with the recognition of *Carrichtera* as a separate genus from *Vella* (including *Boleum* and *Euzomodendron*). It resembles most taxa of *Vella* in having a cochleariform upper fruit segment, strongly veined valves, colored petal veins, dehiscent ellipsoid valvular fruit segments, and short pedicels. However, *Carrichtera* differs in being an annual herb with free inner filaments, and much shorter (3–4 vs. 7–15 mm) petal claws. The distinct generic status of *Carrichtera* is also supported by differences in chloroplast DNA restriction site data (Warwick & Black, 1994), ITS sequence data (Crespo et al., 1998), and chromosome numbers (Gómez-Campo & Hinata, 1980; Warwick & Anderson, 1993).

The limits of *Vella* are expanded here to include both *Boleum* and *Euzomodendron*. The combined genus consists of seven species, and names for all except one are available in *Vella*.

Vella L., Sp. Pl. 2: 641. 1753. TYPE: *Vella pseudocytisus* L.

Boleum Desvaux, J. Bot. 3: 163. 1815. Syn. nov. TYPE: *Boleum asperum* (Persoon) Desvaux.
Euzomodendron Cosson, Notes Pl. Crit. 144. 1852. Syn. nov. TYPE: *Euzomodendron bourgaeanum* Cosson.

Shrubs to 1 m tall, spiny or unarmed, sparsely to densely hairy to setose. Leaves entire to pinnatisect, sessile to short petiolate. Inflorescences ebracteate, few- to many-flowered racemes; flowering pedicels obsolete to short, rarely to 3 mm in fruit. Sepals erect, lateral pair saccate at base. Petals yellow, pale yellow, or cream, with reddish brown or violet veins; claw slender, much longer than sepals. Stamens tetradynamous; inner filaments united in pairs. Lateral nectar glands 2-

lobed to prismatic or semi-annular; median glands present or absent. Style as long as ovary or shorter; stigma capitate. Fruits 2-segmented, sessile or on a gynophore to 2 mm; valvular segment globose to ellipsoid or linear-lanceolate, 1–8-seeded per locule, dehiscent or rarely indehiscent; valves strongly 3- or 5-veined, hispid to setiform or rarely glabrous; septum complete; upper segment lingulate to ensiform or cochleariform, seedless. Seeds with a vestigial wing, rarely winged all around; cotyledons conduplicate. Chromosome number: $x = 17$.

1a. Plants spiny, inflorescences few-flowered.
  2a. Fruits hairy, upper segment 12–15 mm long; leaves usually pinnatisect or several-lobed, apex obtuse . . . . . *V. mairei* Humbert
  2b. Fruits glabrous, upper segment 6–7 mm long; leaves usually entire, rarely 1- or 2-lobed, apex acute . . . . . *V. spinosa* Boissier
1b. Plants not spiny, inflorescences many-flowered.
  3a. Valvular fruit segment linear-lanceolate, 20–35 mm long; seeds distinctly winged all around . . . *V. bourgaeana* (Cosson) Warwick & Al-Shehbaz
  3b. Valvular fruit segment globose or ellipsoid, 3–6 mm long; seeds with a vestigial wing.
    4a. Leaf apex obtuse to rounded; upper fruit segment cochleariform . . . . . *V. pseudocytisus* L.
    4b. Leaf apex acute to acuminate; upper fruit segment lingulate.
      5a. Leaves and sepals appressed hairy; plants of Morocco . . . . . *V. anremerica* (Litardière & Maire) Gómez-Campo
      5b. Leaves and sepals spreading hairy or setose; plants of Spain.
        6a. Leaves linear, to 2 mm wide, entire; fruit on a gynophore ca. 1 mm long, lower segment dehiscent . . . . . *V. lucentina* M. B. Crespo
        6b. Leaves linear lanceolate, 2–4.5 mm wide usually with 1 or 2 pairs of lateral lobes, rarely entire; fruit sessile, lower segment indehiscent . . . . . *V. aspera* Persoon

Vella bourgaeana (Cosson) Warwick & Al-Shehbaz, comb. nov. Basionym: *Euzomodendron bourgaeanum* Cosson, Notes Pl. Crit. 145. 1852. TYPE: Spain. "In calcareis salsuginosis Hispaniae orientalis australioris, in ditione Almeriensi ad basim montis Sierra de Gador inter oppida Santa Fe et Huesica," 6 June 1851, *E. Bourgeau 1055* (holotype, P).

Acknowledgments. We are grateful to Oliver Appel for providing information on various genera and to Gerald A. Mulligan, Lynn Black, and Ardath Francis for their comments on the manuscript.

Literature Cited

Ball, P. W. 1993. *Lunaria. In:* T. G. Tutin et al. (editors), Flora Europaea, ed. 2, 1: 358. Cambridge Univ. Press, Cambridge (U.K.).

Borgen, L. 1987. *Lobularia* (Cruciferae), a biosystematic study with special reference to the Macaronesian region. Opera Bot. 91: 1–96.

Crespo, M. B. 1992. A new species of *Vella* L. (Brassicaceae) from the south-eastern part of the Iberian Peninsula. Bot. J. Linn. Soc. 109: 369–376.

———, M. D. Lledó, M. F. Fay & M. W. Chase. 1998. Subtribe Vellinae (Brassiceae, Brassicaceae): A combined analysis of ITS rDNA sequences and morphological data. Amer. J. Bot. (in press).

Gómez-Campo, C. 1978. Studies on Cruciferae: VI. Geographical distribution and conservation status of *Boleum* Desv., *Guiraoa* Coss. and *Euzomodendron* Coss. Anal. Inst. Bot. Cavanilles 35: 165–176.

———. 1980. Morphology and morpho-taxonomy of the tribe Brassiceae. Pp. 3–31 *in* S. Tsunoda, K. Hinata & C. Gómez-Campo (editors), *Brassica* Crops and Wild Allies. Japan Science Societies Press, Tokyo.

———. 1981. Taxonomic and evolutionary relationships in the genus *Vella* L. (Cruciferae). Bot. J. Linn. Soc. 82: 165–179.

———. 1993. *Vella. In:* S. Castroviejo et al. (editors), Flora Iberica 4: 414–417. Real Jardín Botánico, Madrid.

——— & K. Hinata. 1980. A check list of chromosome numbers in the tribe Brassiceae. Pp. 51–63 *in* S. Tsunoda, K. Hinata & C. Gómez-Campo (editors), *Brassica* Crops and Wild Allies. Japan Science Societies Press, Tokyo.

——— & M. E. Tortosa. 1974. The taxonomic and evolutionary significance of some juvenile characters in the Brassiceae. Bot. J. Linn. Soc. 69: 105–124.

Greuter, W., H. M. Burdet & G. Long (Editors). 1986. Cruciferae. Med-checklist 3: 34–172. Conservatoire et Jardin Botaniques de la Ville de Genève, OPTIMA, Genève.

Heywood, V. H. 1993. *Euzomodendron*, *Vella*, and *Boleum*. *In:* T. G. Tutin et al. (editors), Flora Europaea, ed. 2, 1: 403–404, 413. Cambridge Univ. Press, Cambridge (U.K.).

López-González, G. 1993. *Euzomodendron. In:* S. Castroviejo et al. (editors), Flora Iberica 4: 344–346. Real Jardín Botánico, Madrid.

Maire, R. 1967. Flore de l'Afrique du Nord. 13: 1–365. Paul Lechevalier, Paris.

Marcos-Samaniego, N. 1993. *Boleum. In:* S. Castroviejo et al. (editors), Flora Iberica 4: 419–421. Real Jardín Botánico, Madrid.

Rollins, R. C. 1993. The Cruciferae of Continental North America. Stanford Univ. Press, Stanford.

Schulz, O. E. 1919. Cruciferae–Brassiceae. Part 1. *In*: A. Engler (editor), Pflanzenr. IV. 105(Heft 70): 1–290.

———. 1923. IV. 105. Cruciferae–Brassiceae. Part 2. *In*: A. Engler (editor), Pflanzenr. IV. 105(Heft 84): 1–100.

———. 1936. Cruciferae. *In*: A. Engler & K. Prantl (editors), Natürlichen Pflanzenfamilien ed. 2, 17B: 227–658.

Warwick, S. I. & J. K. Anderson. 1993. Guide to the wild germplasm of *Brassica* and allied crops. Part II. Chromosome numbers in the tribe Brassiceae (Cruciferae). Agriculture Canada Res. Branch Tech. Bull. 1993-15E.

——— & L. D. Black. 1994. Evaluation of the subtribes

Moricandiinae, Savignyinae, Vellinae and Zillinae (Brassicaceae, tribe Brassiceae) using chloroplast DNA restriction site variation. Canad. J. Bot. 72: 1692–1701.

——— & A. Francis. 1994. Guide to the wild germplasm of *Brassica* and allied crops. Part V. Life history and geographical data for wild species in the tribe Brassiceae (Cruciferae). Agriculture Canada Res. Branch Tech. Bull. 1994-2E.

Erratum

Soreng, R. J. 1998. An Infrageneric Classification for *Poa* in North America, and Other Notes on Sections, Species, and Subspecies of *Poa*, *Puccinellia*, and *Dissanthelium* (Poaceae). Novon 8: 189.

As pointed out by G. Davidse, the author of *Poa* section *Dioicopoa* should be E. Desvaux, not (E. Desvaux) Bentham (as suggested by Soreng, 1998). Desvaux (in C. Gay, Fl. Chile, 1853) used one symbol for most of his infrageneric taxa, but in rare cases, as in *Stipa* (p. 275), he explicitly stated that he intended that rank to be section. In *Agrostis*, he started with this symbol and then changed to the abbreviation "secc." for the other sections. Following ICBN Art. 35.4, individual publications should be interpreted as a whole, and thus all of Desvaux's infrageneric taxa using the same symbol should be considered as sections.

Volume 8, Number 3, pp. 215–326 of NOVON was published on 14 September 1998.

Volume 8
Number 4
1998

NOVON

A New *Pegaeophyton* (Brassicaceae) from Nepal

Ihsan Al-Shehbaz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Katsutoshi Arai
Karuizawa Botanical Garden, Hocchi 1166, Karuizawa-machi, Kitasaku-gun, Nagano Pref., Japan

Hideaki Ohba
Department of Botany, University Museum, University of Tokyo, 7-3-1 Hongo, Tokyo, 113 Japan

ABSTRACT. *Pegaeophyton nepalense* is described and illustrated. Its relationship to the other species of *Pegaeophyton* is discussed.

Pegaeophyton Hayek & Handel-Mazzetti is a genus of three Himalayan species restricted to high altitudes in Bhutan, China (Gansu, Qinghai, Sichuan, Xinjiang, Xizang, Yunnan), India (Assam, Sikkim, Uttar Pradesh), Myanmar, Nepal, and Pakistan (Kashmir). Many of the high-elevation Himalayan Brassicaceae are rather small, often overlooked, and poorly collected. The following new species is no exception, and it is known thus far from two collections, one each from eastern Nepal and adjacent Sikkim.

Pegaeophyton nepalense Al-Shehbaz, Arai & H. Ohba, sp. nov. TYPE: Nepal. Around Lamni Nama, 4200–4900 m, 15 Aug. 1977, *H. Ohashi, H. Kanai, H. Ohba & Y. Tateishi 775117* (holotype, TI; isotype, MO). Figure 1.

Herba perennis nana. Folia rosulata, suborbiculata vel late ovata, 2–3(–4) mm longa, 1.5–2(–3) mm lata, adaxialiter trichomatibus 0.3–0.5 mm longis pubescentia. Inflorescentia uniflora; pedicello 4–5 mm longo. Flos sepalis oblongis, 1.1–1.3 mm longis; petalis albis, unguiculatis, obovatis vel suborbiculatis, 1.6–2 mm longis. Fructus ovoideus, 2–3 mm longus, 1.8–2 mm latus; valvulis membranceis; stylo persistente 0.5–0.7 mm longo; septo nullo; replo valde complanato, 0.4–0.5 mm lato; seminibus 1–1.1 mm longis, 0.5–0.6 mm latis.

Minute perennial herbs with slender caudex ca. 1 mm diam. Leaves 5–12 per caudex, rosulate, adaxially moderately pubescent with trichomes 0.3–0.5 mm long, abaxially glabrous; petiole (3–)6–10(–14) mm long, slender at base, glabrous or with few trichomes; blade suborbicular to broadly ovate, 2–3(–4) mm long, 1.5–2(–3) mm wide, somewhat fleshy, base obtuse, margin entire, apex obtuse to subrounded. Flowers 3–8 per plant, solitary. Pedicels slender, distally pubescent with trichomes 0.3–0.5 mm all around, 4–5 mm at anthesis, not elongated in fruit. Sepals oblong, 1.1–1.3 mm long, 0.5–0.7 mm wide, free, spreading, not saccate, pubescent on distal half with trichomes to 0.3 mm long, membranous margin 0.05–0.1 mm wide, obtuse. Petals white, broadly obovate to suborbicular, slightly emarginate, 1.6–2 mm long; blade 0.8–1.1 mm long, 0.8–1.1 mm wide; claw 0.8–1.2 mm long. Filaments erect, white, slightly dilated at base, 1.2–1.5 mm long, persistent to fruit maturity; anthers suborbicular, 0.25–0.3 mm long, slightly sagittate at base. Nectar glands confluent, appearing as a tooth on each side of lateral stamen. Ovules 2–4. Fruit broadly ovoid to subglobose, 2–3 mm long,

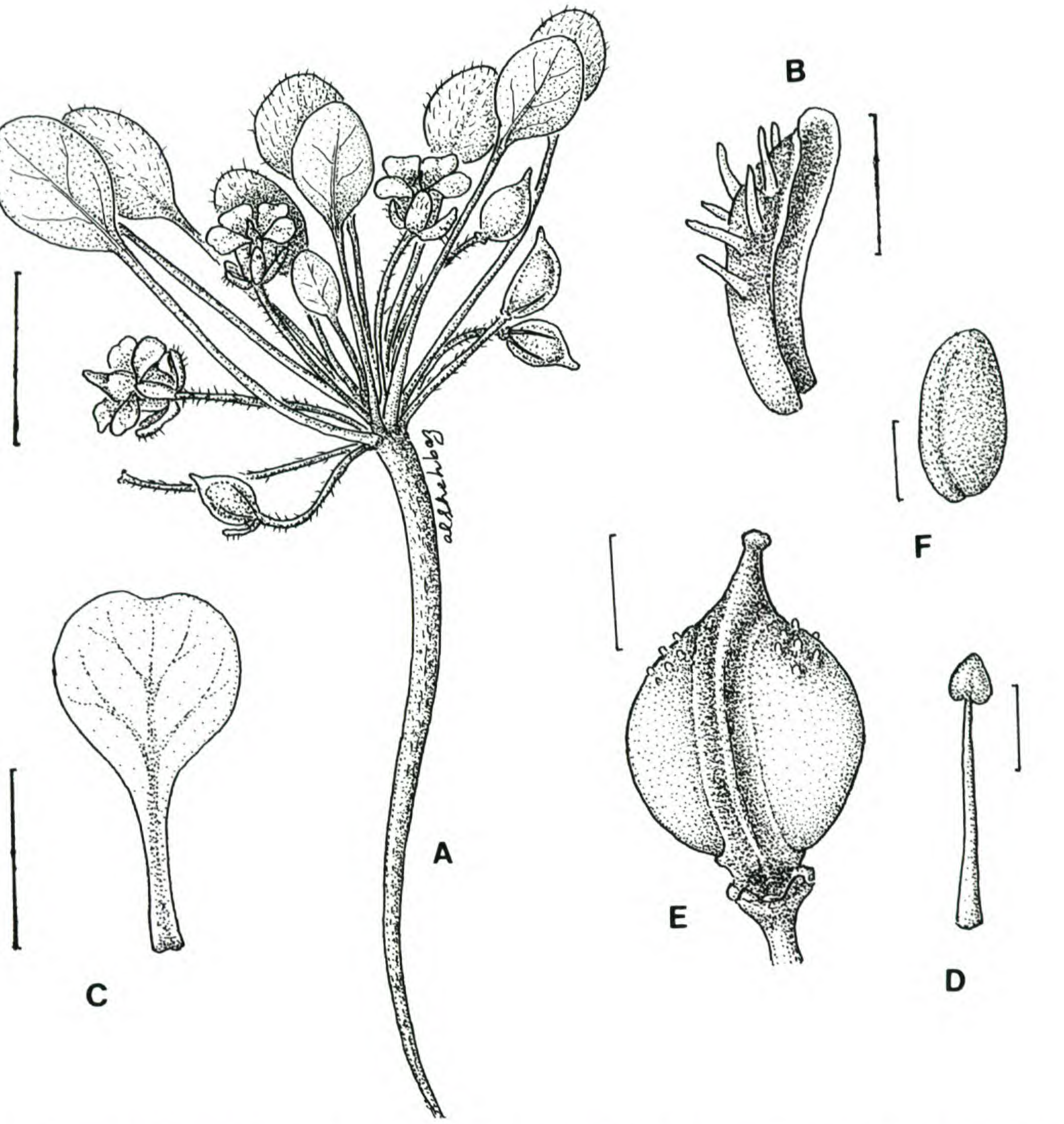


Figure 1. *Pegaeophyton nepalense*. —A. Plant. —B. Sepal. —C. Petal. —D. Stamen. —E. Fruit. —F. Seed. Scale bars: A = 5 mm; B, D & F = 0.5 mm; C & E = 1 mm. Drawn from the isotype at MO.

1.8–2 mm wide; valves membranous, rounded, usually minutely puberulent distally; gynophore 0.1–0.2 mm long; style 0.5–0.7 mm long; stigma entire; septum absent; replum strongly flattened, 0.4–0.5 mm wide, glabrous. Seeds oblong, brown, plump, 2–4 per fruit, 1–1.1 mm long, 0.5–0.6 mm wide.

Pegaeophyton nepalense is the smallest member of the genus. It is most closely related to *P. scapiflorum* (J. D. Hooker & Thomson) C. Marquand & Airy Shaw, from which it is readily distinguished by having ovoid to subglobose fruits with membranous, usually apically puberulent valves, sepals 1.1–1.3 mm long, petals 1.6–2 mm long, and plump seeds 1–1.1 × 0.5–0.6 mm. In contrast, *P. scapiflorum* has flattened, oblong to orbicular or ovate fruits with glabrous, papery valves, sepals (2–)3–10 mm long, petals (4.5–)5–12(–15) mm long, and flattened seeds (1.5–)2–3.2(–4) × 1–2(–3) mm. The latter species is quite variable and has been divided by Schulz (1926) and Guo (1987) into three varieties. *Pegaeophyton nepalense* is easily distinguished from *P. minutum* H. Hara, a species of Nepal, Sikkim, Bhutan, and Tibet (Hara, 1972), by having ovoid to subglobose instead of narrowly oblong fruits, trichomes 0.3–0.5 mm long instead of 0.02–0.08 mm long, and pedicels pubescent all around instead of one line extending along the entire pedicel length. The identity of *P. garhwalense* Chowdhery & Singh remains uncertain, and we have not examined any material of that species. Ac-

cording to Chowdhery and Singh (1985), *P. garhwalense* has pubescent filaments, a feature not yet reported for any of the Himalayan Brassicaceae with solitary flowers. The original description of the latter species neither indicated whether or not the septum is lacking nor described the cotyledonary position, both of which are key characters for the delimitation of *Pegaeophyton*.

Paratypes. INDIA. **Sikkim:** West District, near Goecha La, 37°36′N, 88°11′E, *Long, McBeath, Noltie & Watson 605* (CAS, E, MO).

Acknowledgments. We are grateful to Roy Gereau for correcting the Latin.

Literature Cited

Chowdhery, H. J. & S. Singh. 1985. A new species of *Pegaeophyton* (Brassicaceae) from northwestern Himalaya. Indian J. Forestry 8: 335–337.

Guo, R. L. 1987. *Pegaeophyton. In:* T. Y. Cheo (editor), Fl. Reipubl. Popularis Sin. 33: 242–244.

Hara, H. 1972. New or noteworthy flowering plants from eastern Himalaya (11). J. Jap. Bot. 47: 269–277.

Schulz, O. E. 1926. Diagnosen neuer, hauptsächlich in China gesammelter Cruciferen. Notizbl. Bot. Gart. Berlin-Dahlem 9: 473–477.

A New Species of *Aldina* (Fabaceae: Caesalpinioideae) from Venezuelan Amazonia

Gerardo Aymard C.
UNELLEZ-Guanare, Herbario Universitario (PORT), Mesa de Cavacas, Edo. Portuguesa 2333, Venezuela

ABSTRACT. *Aldina paulberryi* (Fabaceae: Caesalpinioideae), a new species from Amazonian lowland forest, is described and illustrated, and its relationship with *A. reticulata* is discussed.

Aldina paulberryi Aymard, sp. nov. TYPE: Venezuela. Amazonas: Río Orinoco, cerca de Macuruco, bosques húmedos, 200 m, 3 Mar. 1976, *P. Berry 2125* (holotype, VEN; isotypes, MO, NY). Figure 1.

A. reticulatae R. S. Cowan affinis, sed ab ea foliolis late ovatis vel orbicularibus, venatione tertiaria inconspicua usque obsoleta, petalis 5, 1–1.5 cm longis, filamentis 5–6 mm longis, antheris 4–5 mm longis; ovario lineari-elliptico, 2–4 mm longo, stylo ca. 3 mm longo, stipite 2–5 mm longo diversa.

Tree 15 m tall; branches and branchlets densely yellow pubescent, becoming glabrous when mature. Leaves 3-foliolate or the uppermost 1-foliolate, alternate; petioles ca. 5 cm long, densely yellow pubescent, becoming glabrous when mature, petiolules 1–2.5 cm long, densely yellow pubescent, articulate at apex; leaflets chartaceous to subcoriaceous, broadly ovate to orbicular, 7–15 cm long, 6–14 cm wide, the base acute to subcordate, the apex obtuse, margins subrevolute, entire, glabrous on the upper surface, yellow appressed-pubescent on the lower surface, more densely so on the midrib and secondary nerves, becoming glabrous and gray-green when mature, secondary nerves conspicuous, 7–13 on each side, tertiary venation inconspicuous to obsolete. Inflorescence axillary, simple, 7–19-flowered, 11–19 cm long, densely yellow appressed-pubescent, becoming glabrous when mature. Flowers pedicellate, pedicels 2.5–5 mm long, articulate at the base, densely yellow appressed-pubescent; calyx entire in bud, opening apically, hypanthium 1–1.3 cm long, densely yellow appressed-pubescent, sepals 3 or 4, 4–5 mm long, 2–5 mm wide, ovate, densely yellow appressed-pubescent externally, glabrous internally; petals 5, 1–1.5 cm long, white, obovate, unguiculate at the base, glabrous on both surfaces; stamens 30–40, white, uniform, connate at the base, filaments glabrous, 5–6 mm long, anthers glabrous, linear, dorsifixed, 4–5 mm long; ovary linear-elliptic, striate, 2–4 mm long, densely yellow pubescent, style glabrous, ca. 3 mm long, stipe densely yellow pubescent, glabrous at the base, 2–5 mm long, stigma terminal, fruit obovoid, ca. 2.5 cm long, woody, 1-seeded. (Fig. 1.)

Distribution and ecology. Known only from the type locality, where it has been collected in lowland humid forest.

Aldina paulberryi is most closely allied to *A. reticulata* Cowan, from Venezuelan Amazon montane forests (Cowan, 1953, 1961), but differs in having leaflets broadly ovate to orbicular, tertiary venation inconspicuous to obsolete, 5 petals 1–1.5 cm long, filaments 5–6 mm long, anthers 4–5 mm long, ovary linear-elliptic, 2–4 mm long, style ca. 3 mm long, and stipe 2–5 mm long. In contrast, *A. reticulata* is characterized by leaflets oblong to oblong-ovate, tertiary venation strongly reticulate, 4 petals ca. 2.5 cm long, filaments ca. 1.5 mm long, anthers ca. 7 mm long, ovary oblong-ovate, 4–5 mm long, and style 3–6 mm long.

This species is named in honor of Paul E. Berry for his significant contributions to our knowledge of the flora of the Venezuelan Guayana.

Acknowledgments. I thank Kay Yatskievych (MO), David Neill (MO), and James Zarucchi (MO) for valuable comments and observations on the manuscript. I am grateful to Roy Gereau (MO) for revising the Latin diagnosis, to Robert Magill (MO) and the Missouri Botanical Garden staff for making their facilities available for my research, and to Bobbi Angell for preparing the illustration.

Literature Cited

Cowan, R. S. 1953. Caesalpinioideae. *In:* B. Maguire et al., The botany of the Guayana highland (A report of the Kunhardt, the Phelps, and The New York Botanical Garden Venezuelan Expeditions). Mem. New York Bot. Gard. 8: 103–115.

———. 1961. The botany of the Guayana Highland IV. Mem. New York Bot. Gard. 10: 1–87.

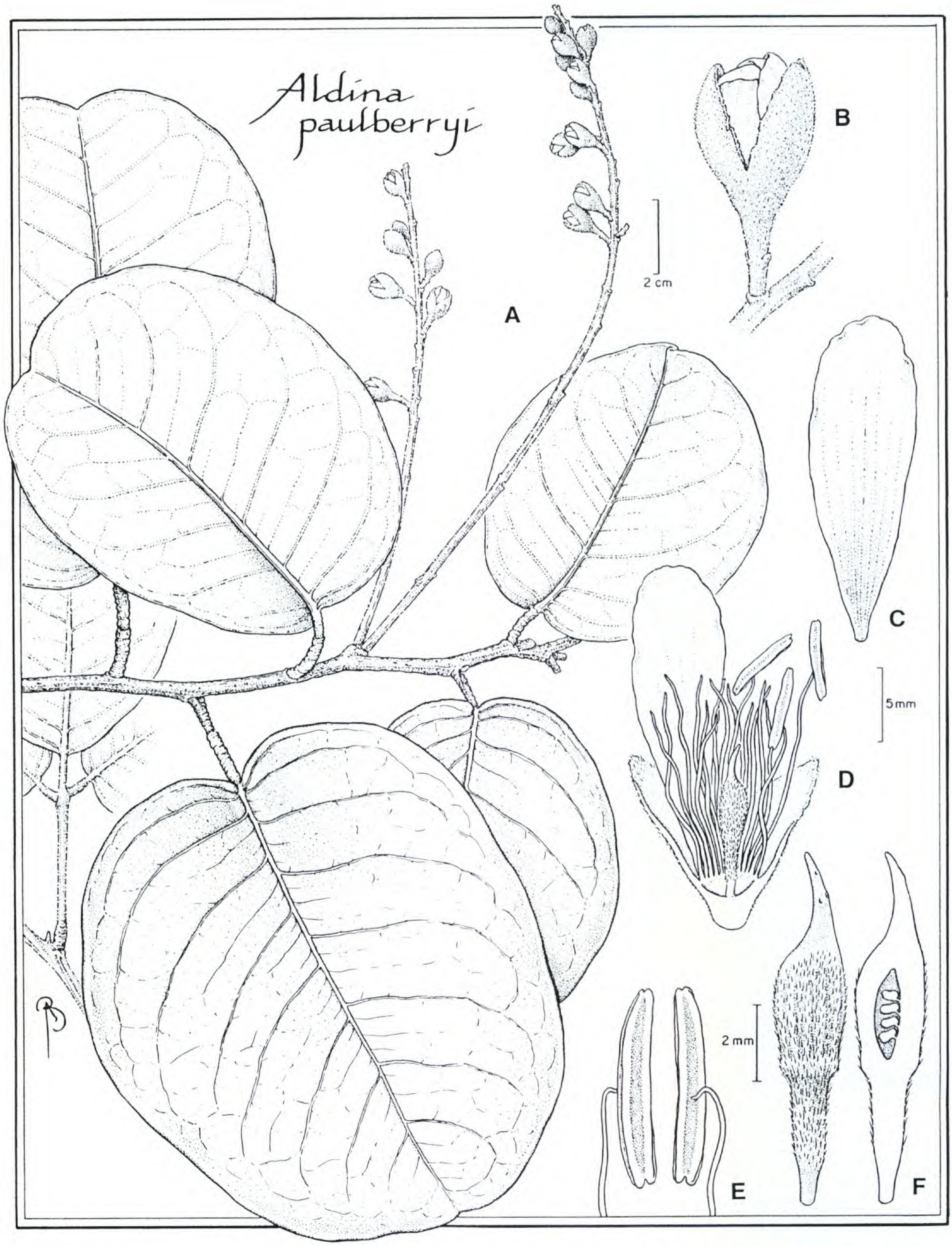


Figure 1. *Aldina paulberryi* Aymard. —A. Inflorescence with mature leaflets. —B. Calyx in bud, opening apically. —C. Petal. —D. Detail of open flower. —E. Anthers and filaments. —F. Ovary and stipe. (Drawn from the type: *Berry 2125.*)

A New Combination in *Melanthium* L. (Liliaceae)

Norlyn L. Bodkin
Arboretum, Department of Biology, James Madison University, Harrisonburg, Virginia 22807, U.S.A.

ABSTRACT. The new combination *Melanthium woodii* (Robbins ex Wood) Bodkin, made but not effectively published in my doctoral dissertation, is here validated in anticipation of its use in the forthcoming account of the genus in *Flora of North America*.

Melanthium L. (Liliaceae) is a genus of perhaps eight species, four of them found in North America from central Iowa eastward to southern New York, south to northern Florida and eastern Texas; the other four are found in southwest China. The type species, *M. virginicum* L., occurs over this entire range, commonly in swamps, marshes, and bogs. *Melanthium latifolium* Desrousseaux, found mostly on rich wooded slopes, and *M. parviflorum* (Michaux) Watson, of higher elevations, occur mainly in the mid-Appalachian mountains. Another species, recognized previously as *Veratrum woodii* Robbins ex Wood and here transferred to *Melanthium*, is known only from rich deciduous slopes of the Ozark Plateau, where it is rare, and from five small disjunct populations in North Carolina, Georgia, and Florida.

In my revision of *Melanthium* (Bodkin, 1978), I maintained this genus as distinct from *Veratrum* L. on the basis of leaf size and shape, inflorescence characters, features of the tepal glands and claws, adnation of stamens to tepals, and general habit of the plants. According to these criteria, the species heretofore recognized as *Veratrum woodii* belongs with the other species of *Melanthium*. In anticipation of its use in my forthcoming account of *Melanthium* in *Flora of North America*, the new combination, made but not effectively published in my 1978 work, is here validated.

Melanthium woodii (Robbins ex Wood) Bodkin, comb. nov. Basionym: *Veratrum woodii* Robbins ex Wood, Class-book bot. ed. 2, 557. 1847. TYPE: U.S.A. Indiana: Greene Co., deep woods, July, *Wood s.n.* (holotype, GH).

Veratrum intermedium Chapman, Fl. S. U.S. 489. 1860. SYNTYPES: U.S.A. Florida: Gadsden Co.: rich, shady hummocks, 1835, *Chapman s.n.* (lectotype, here designated, GH); U.S.A. Florida: *s.l.*, *s.d.*, *Chapman s.n.* (probable type, GH).

When Wood published the name *Veratrum woodii* and the accompanying description, he cited Robbins as author. There has been some confusion as to whether Robbins should be cited "in Wood" or "ex Wood." There is no indication or acknowledgment that Robbins actually wrote the description, so the correct citation is Robbins ex Wood. The description is thorough and agrees in all characters with the type at GH.

Acknowledgments. I deeply appreciate the assistance given by James Reveal, University of Maryland, and Robert Kiger, Hunt Institute, in the preparation of my revision of North American *Melanthium*.

Literature Cited

Bodkin, N. L. 1978. A Revision of North American *Melanthium* L. (Liliaceae). Ph.D. Dissertation. University of Maryland.

A New Southern Hemisphere Species of *Potentilla* (Rosaceae)

A. Castagnaro and J. Diaz Ricci
Instituto Superior de Investigaciones Biológicas, Universidad Nacional de Tucumán, Chacabuco 461, 4000-Tucumán, Argentina

M. Arias and P. Albornoz
Facultad de Ciencias Naturales e I.M.L. y F.M.L., Parque Biológico, Universidad Nacional de Tucumán, Lillo 205, 4000-Tucumán, Argentina

ABSTRACT. *Potentilla tucumanensis* A. Castagnaro & M. Arias, sp. nov., from Tucumán, Argentina, is described and illustrated. *Potentilla tucumanensis* was originally determined as *P. norvegica.* The latter and *P. anserina* were the only two species of this large genus primarily of the Northern Hemisphere cited from Argentina. *Potentilla tucumanensis* is distinguished from *P. norvegica* by morphological-reproductive (flowers and achenes), anatomical (stomata), and genetic (chromosome number) characters.

The genus *Potentilla* belongs to the family Rosaceae and includes approximately 500 species of annual and perennial herbs and shrubs (Davidson, 1995), most of them from the Northern Hemisphere (Acharya-Goswami & Matfield, 1975). *Potentilla norvegica* was characterized by Linnaeus (1753) as a Scandinavian species. In 1900 Lillo found morphologically similar specimens in Tucumán (Argentina), which he identified it as *P. norvegica.* Later, Zardini (1973) cited this species from Córdoba and La Rioja, and Novara (1993) observed similar specimens in the Valle de Lerma, province of Salta, Argentina (Fig. 1). However, studies carried out by our group with recently collected material, comparison with materials from different herbaria, and an exhaustive literature search revealed that all specimens found in Argentina that were erroneously called *P. norvegica* belong to a new species designated here as *P. tucumanensis* (Fig. 2); this new species does not resemble any other European or North American species (Focke, 1888; Wolf, 1908; Rothmaler, 1959; Kalkman, 1968; Werner & Soule, 1976; Fitter et al., 1986; Ikeda & Ohba, 1993). Furthermore, the true *P. norvegica* does not occur in Argentina or at least has not yet been reported from there. The main morphological-reproductive, anatomical, and genetic differences observed between *P. tucumanensis* and the European *P. norvegica* are shown in Table 1. Despite the fact that this plant was originally classified as *P. norvegica* because of its broad similarities to the European species, we have considered it to be novel not only for its diploid status, but also because morphological and anatomical analyses (Ikeda & Ohba, 1993; Leht, 1991) showed relevant taxonomic characters that clearly discriminate *P. tucumanensis* from *P. norvegica.* The name "tucumanensis" refers to the geographical region that in the colonial period was called "Región del Tucumán."

Potentilla tucumanensis A. Castagnaro & M. Arias, sp. nov. TYPE: Argentina. Tucumán: Dpto. Trancas, Loc. Potrero, 1500–1600 m, sunny disturbed areas, 12 Sep. 1996, *D. Kirschbaum 11* (holotype, LIL 602866). Figure 2.

Herba annua erecta 10–30 cm alta. Folia trifoliolata pubescentia, basalia petiolis longis apicaliaque petiolis brevibus insidentia; foliolo terminali 6–20 mm longo, 5–15 mm lato, elliptico, profunde bidentato; venatione brochidodroma; estipulis bipartitis. Inflorescentia ex flore solitario constans; bracteolis calyculi elliptico-lanceolatis, apice attenuatis, pubescentibus, venatione reticulata. Flos 3–6 mm longus, 4–9 mm latus; sepalis triangularibus; petalis flavis, lanceolato-spathulatis, glabris, venatione dichotoma, 1.8–2.5 mm longis, 0.7–1.5 mm latis; staminibus 15 tricyclis aequalibus, filamentis filiformibus curvatis, antheris subglobosis. Achenia ochracea, reniformia; tegumento laevi, rare alato; stylo in fructu persistente, membranaceo; stigmate bilobo, incurvato. Numerus chromosomatum: $2n = 2x = 14$.

Annual herb, erect, 10–30 cm high; root unbranched, vertical. Leaves 3-foliolate, pubescent with glandular and unicellular trichomes on both sides of epidermal leaves; terminal leaflet 6–20 × 5–15 mm, elliptic, deeply bidentate; basal leaves with long petioles (30–70 mm) and apical leaves with short petioles (1–30 mm); stipules bipartite; venation brochidodromous. Flower solitary, 3–6 × 4–9 mm; peduncle 5–15 mm long; epicalyx bracteoles elliptic-lanceolate with attenuate apex, 2.5–3.5 × 0.8–1.0 mm, pubescent with reticulated veins. Sepals triangular, veins reticulated, pubes-

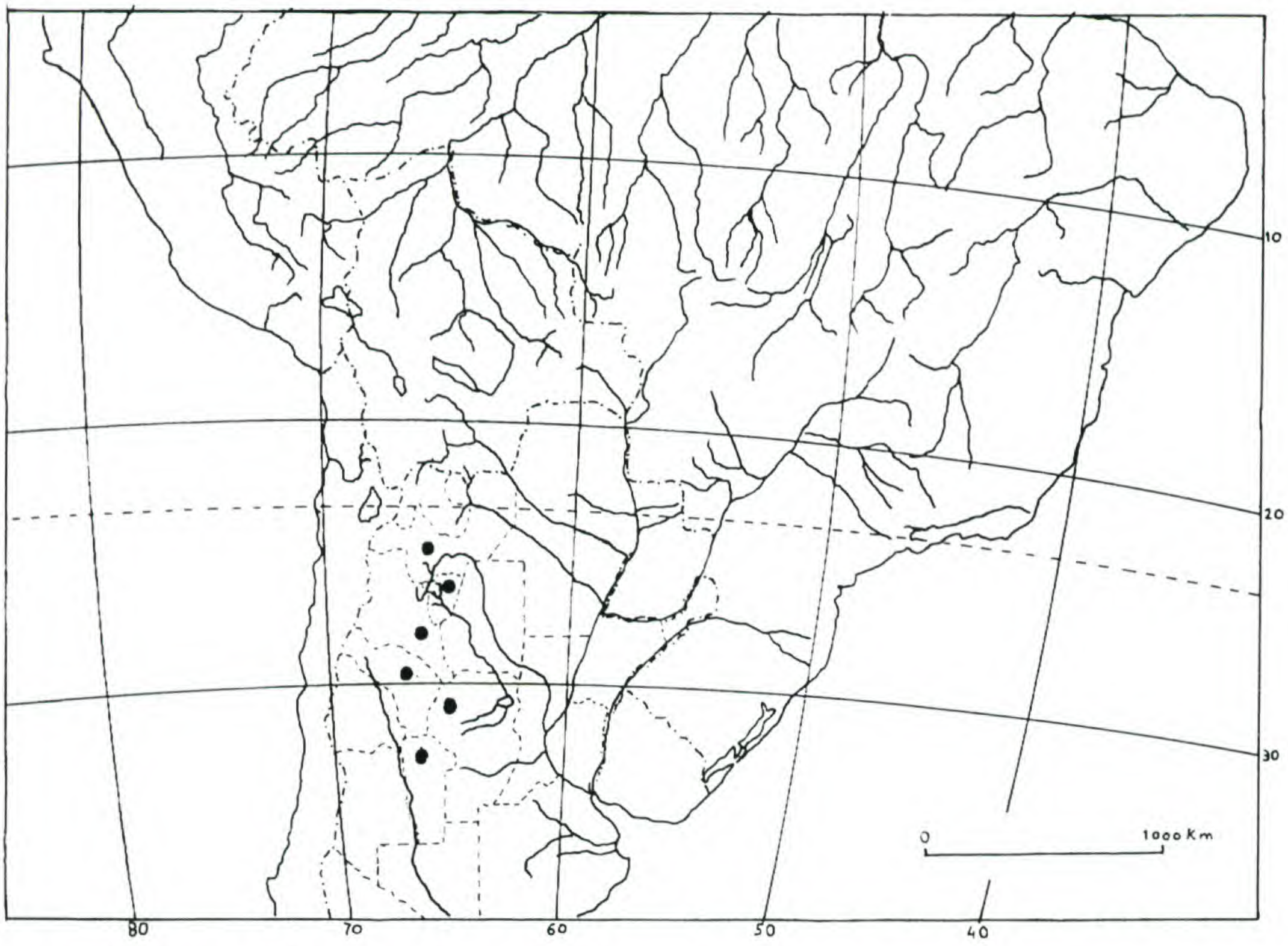


Figure 1. Distribution of *Potentilla tucumanensis* in Argentina.

Table 1. Comparison of morphological, anatomical, and genetic characters of *Potentilla tucumanensis* and *P. norvegica*.

	P. tucumanensis	*P. norvegica**
Habit	Annual herb, erect, 10–30 cm long	Annual, biennial, or (rarely) short-lived perennial 20–60 cm long
Root	Simple and vertical	Simple, vertical, often thick, biennial and perennial
Leaves	3-foliolate; lower leaves on long petioles, upper ones nearly or very sessile; leaflets deeply bidentate	Lower leaves on long petioles, upper ones nearly or very sessile; each leaf consists of 3 oval, coarsely toothed leaflets
Stipules	Extended, bipartite	Extended, bipartite, split at the tip
Flowers	Solitary, yellow; 3–6 mm	Inflorescence, leafy cyme at the end of the branches, yellow; 7–10 mm
Petals	Yellow, lanceolate-spatulate; 1.8–2.5 mm long	Yellow, orbiculate; 3–5 mm long
Achenes	Renifom, with smooth coat, ochre; occasionally winged; 0.5–0.7 mm long	Ovoid or nearly round, pale brown with shallow longitudinal ridges; 0.8–1.3 mm long
Stomata apparatus	Non-contiguous stomata	Contiguous stomata**
Stomata length × width [μm]	Upper epidermis: 34.0 × 29.3 (± 0.8)	Upper epidermis: 28.1 × 20.4 (± 0.5)
	Lower epidermis: 29.8 × 24.5 (± 0.8)	Lower epidermis: 25.0 × 19.9 (± 0.3)
Chromosome number	$2n = 2x = 14$	$2n = 10x = 70$

* *P. norvegica* L.: synonyms, *P. monspeliensis* L., *P. monspeliensis* L. var. *norvegica* (L.) Rydberg, *P. millagrana* Engelmann ex Lehmann. From Werner & Soule (1976).

** From Leht, M. (1991).

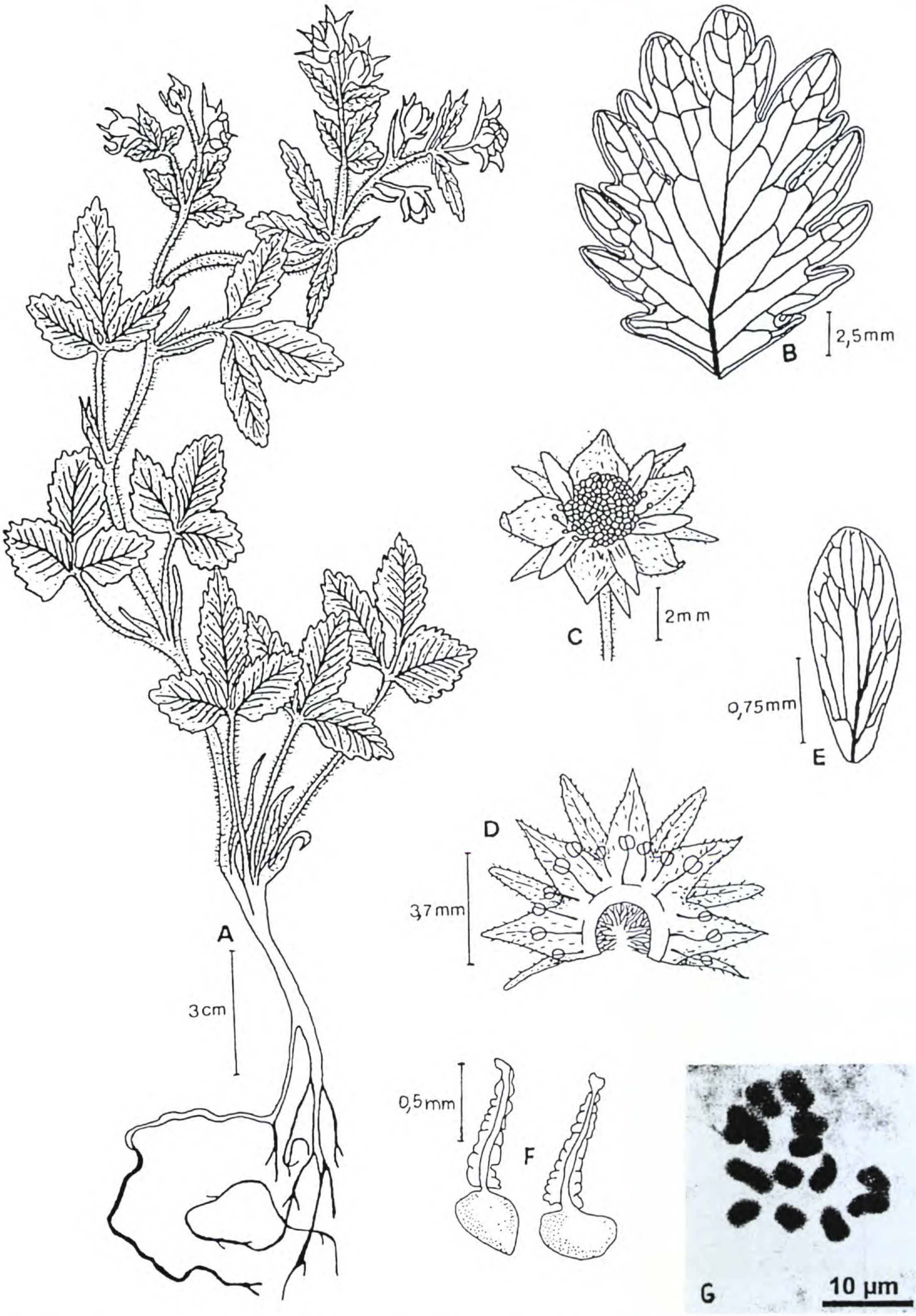


Figure 2. *Potentilla tucumanensis* A. Castagnaro & M. Arias. —A. Habit. —B. Terminal leaflet. —C. Flower. —D. Detail of stamen distribution in open flower. —E. Detail of petal. —F. Two views of achenes showing the persistent membranous style and the bent bilobulate stigma. —G. Micrography of mitotic metaphase ($2n = 2x = 14$; holotype).

cent, 3.7–5 × 1.3–2 mm; petals yellow, lanceolate-spatulate with dichotomous veins, glabrous, 1.8–2.5 × 0.7–1.5 mm; stamens 15, distributed in 3 cycles of 5 stamens each, filament curved, filiform, 0.6–1.1 mm long, anthers subglobose, 0.2–0.4 mm long. Achenes ochre, reniform, 0.5–0.7 mm long, with smooth coat, rarely winged; style persistent in fruit, membranous, 0.4 mm long; stigma bent, bilobulate. Chromosome number: $2n = 2x = 14$.

Habitat. *Potentilla tucumanensis* was found in open, sunny, disturbed, often fallow lands, near streams, corresponding to the mountainous dry Chaco phytogeographic region (Cabrera, 1976).

Paratypes. ARGENTINA. **Tucumán:** San José, 2200 m, 19 Dec. 1900, *Lillo 2625* (LIL); La Ciénega, 2600 m, 17 Apr. 1904, *Lillo 3737* (LIL); Cañada del Muñoz, 1700 m, July 1911, *Castillón 2790* (LIL); Yerba Buena, forest, 550 m, 6 Nov. 1913, *Lillo 13242* (LIL); El Potrerillo, 600 m, 22 Nov. 1913, *Monetti 14872* (LIL); Tafí del Valle, Río Blanco Creek, 2000 m, Feb. 1914, *Castillón 3505* (LIL); Parque Centenario, 450 m, 6 Nov. 1913, *Castillón 3049* (LIL); Chañar Pozo, 300 m, Oct. 1919, *Venturi 446* (LIL); Las Pavas, 2700 m, 17 Mar. 1924, *Venturi 3292* (LIL); Embarcación F.C.C.N., 450 m, 18 Dec. 1925, *Schreiter 5175* (LIL). **Salta:** Sierra de Vélez, nearby Mojotoro River, *Novara 2950* (Herb. G. Tolaba); La Caldera, Ruta 9, 1614 km, 1300–1500 m, 30 Nov. 1987, *Novara 7230* (Herb. G. Tolaba). **Córdoba:** Villa Mercedes, Rio Quinto, 15 Nov. 1940, *Arturo Burkart 10913* (Darwinion); Río Segundo, Puerta de Vélez, approx. 15 km W from Pilar (at the river bank), 1 Nov. 1949, *Krapovickas 6478* (LIL). **Catamarca:** Andalgalá, La Ollada, 20 Feb. 1915, *Jorgensen 1314* (LIL); Andalgalá, 19 Feb. 1915, *Jorgensen 1488* (LIL). **San Luis:** Cerros Largos, 9 Nov. 1940, *Burkart 12108* (Darwinion).

Specimens of P. norvegica *examined.* SWEDEN. Stockholm, Skandull, 3 July 1927, *Fagerlind s.n.* (LIL-236822); Sodermanland, östra Vingaker parish, Forssa bruck, 8 July 1906, *Lindgren s.n.* (LIL-253479).

Acknowledgments. We thank A. M. Türpe, curator of the Miguel Lillo Herbarium, for assistance; M. R. Figueroa Romero for critical review of manuscript; L. Poggio and C. Naranjo for valuable comments; and A. Gutiérrez and G. Velicce for excellent technical assistance. AC and JDR are members of CONICET. This work was partially supported by the Agencia Nacional de Promoción Científica y Tecnológica (PMT-552) and Consejo de Investigaciones de la Universidad Nacional de Tucumán (CIUNT).

Literature Cited

Acharya-Goswami, D. & B. Matfield. 1975. Cytogenetic studies in the genus *Potentilla* L. New Phytol. 75: 135–146.

Cabrera, A. L. 1976. *In* Enciclopedia Argentina de Agricultura y Jardinería—Regiones Fitogeográficas Argentina. Editorial ACME S.A.C.I., Buenos Aires.

Davidson, C. G. 1995. *Potentilla fruticosa*, taxonomy and international registration. Acta Hort. 413: 157–160.

Fitter, R., A. Fitter & M. Blamey. 1986. Pareys Blumenbuch. Verlag Paul Parey, Berlin.

Focke, W. O. 1888. Rosaceae. *In:* Engler & Prantl, Die natürlichen Pflanzenfamilien 3: 1–61.

Ikeda, H. & H. Ohba. 1993. A systematic revision of *Potentilla lineata* and allied species (Rosaceae) in the Himalaya and adjacent regions. Bot. J. Linn. Soc. 112: 159–186.

Kalkman, C. 1968. *Potentilla*, *Duchesnea* and *Fragaria* in Malesia (Rosaceae). Blumea 26: 325–354.

Leht, M. 1991. Micromorphological characters in the systematics of Baltic cinquefoils (*Potentilla*). Botaanilised uurinused. (Scripta Botanica) 6: 150–164.

Linnaeus, C. 1753. Species plantarum. Tomus I. P. 499.

Novara, L. J. 1993. Flora del Valle de Lerma. Rosaceae Juss. Aportes Botánicos de Salta Ser. Flora 2: 34–35.

Rothmaler, W. 1959. Exkursions-Flora Atlas der Gefässpflanzen. Volk und wissen Volkseigener. Verlag, Berlin.

Werner, P. A. & J. D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canad. J. Pl. Sci. 56: 591–603.

Wolf, T. 1908. Monographie der Gattung *Potentilla*. Bibliotheca Botanica, Heft 71.

Zardini, E. M. 1973. Los géneros de Rosáceas espontáneas en la República Argentina. Bol. Soc. Argent. Bot. 15: 209–228.

New Species of *Diplusodon* (Lythraceae) from Brazil

Taciana Barbosa Cavalcanti
National Center for Genetic Resources and Biotechnology, CENARGEN/EMBRAPA
SAIN-Parque Rural, CP 02372, CEP 70.000-970, Brasilia, DF, Brazil

ABSTRACT. Eight new species and two new varieties from five Brazilian states are described and illustrated: *Diplusodon argyrophyllus* and *D. ulei* var. *ciliatus*, from Bahia; *D. alatus*, *D. ciliatiflorus*, *D. oblongus* var. *angustifolius*, *D. plumbeus*, and *D. pygmaeus* from Goiás; *D. aggregatifolius*, from Minas Gerais; *D. trigintus*, from Tocantins; and *D. mattogrossensis*, from Mato Grosso.

Since 1985, expeditions in Brazil have been undertaken to increase knowledge of the Brazilian Lythraceae (Cavalcanti, 1987, 1988, 1990; Ramos et al., 1992) and as a basis for revising the genus *Diplusodon* (Cavalcanti, 1995). These efforts resulted in the collection of many interesting plants in the family, some representing rare and endemic species. In addition to new species of *Cuphea*, some of them already published (Cavalcanti, 1989, 1991), ten taxa of *Diplusodon* were confirmed to be undescribed.

Diplusodon is a genus of about 65 species ranging throughout the continuous area of the Brazilian cerrado, with just 1 species occurring in the cerrado of Bolivia (Cavalcanti & Graham, 1996). The species occur different habitats, including gallery forest borders, grassy fields (campo limpo) with sandy soil, closed cerrado (cerrado denso) with trees and high shrubs, open cerrados (campo sujo), and fields with outcropping rocks (campo rupestre).

In general, *Diplusodon* is characterized by opposite leaves, regular, hexamerous, perigynous flowers with a floral tube, two bracteoles (prophylls), and an epicalyx of six appendages. The gynoecium is bicarpellate and unilocular with an incomplete septum. The androecium can be diplostemonous, polystemonous, or rarely haplostemonous. The fruit is a septicidal capsule with winged seeds.

The species of *Diplusodon* were first studied in detail by Koehne (1903). The most recent work, that of Lourteig (1989), described 18 new species, mainly from Minas Gerais and Goiás. The new species described here further expand the diversification of the genus both in vegetative and floral characters.

The etymology of the genus refers to the sepals of the calyx and the epicalyx of the flowers (diplus = double; odon = teeth).

Diplusodon aggregatifolius T. Cavalcanti, sp. nov. TYPE: Brazil. Minas Gerais: Grão-Mogol, às margens do córrego na saída da cidade, na estrada para o Rio Ventania, 25 Feb. 1986, *Cavalcanti et al. (CFCR) 9596* (holotype, SPF; isotypes, CEN, K, MBM, NY, UEC). Figure 1.

Habitu, amplitudine formaque foliorum et numero staminum *D. ulei* appropinquat, sed hypanthio oblongo et planta omnino trichomatibus foliis evidenter ad apicem ramorum facile distinguitur.

Subshrub 0.4–2.0 m, branchlets sparse, quadrangular to subquadrangular, reddish to wine-colored, pubescent; internodes 0.5–3 cm long. Leaves petiolate, petioles 3–7 mm long; venation eucamptodromous; blades chartaceous to subcoriaceous, elliptic to obovate, rarely orbicular, 0.9–3 × 0.4–1.2 cm, apex obtuse, margin plane to rarely slightly revolute; adaxial surface pubescent, with lateral veins inconspicuous; abaxial surface pubescent, with lateral veins 2–3, visible. Inflorescences bracteose to frondose-bracteose, diplobotrys to pleiobotrys, sometimes with accessory branches; pedicels 1–2.5 mm long; bracteoles 5–7 mm long, elliptic to obovate, with base narrow and decurrent, at the apex of pedicel, reaching to the midpoint of the floral tube. Floral tube 4–5 mm long, campanulate, pubescent; sepals wine-colored, pubescent, 2–2.5 mm long; appendages cylindrical to flattened, 2–2.5 mm long, spreading, slightly reflexed; corolla 2.5–3 cm diam., petals pink, 9–12 × 6–7 mm; stamens (10–)12, exserted; ovary glabrous, rounded to obconic, 2–2.8 × 1.9–2 mm; style rose, 12–19 mm long; ovules 6–14. Capsules rounded; seeds 4–6, 3–3.2 × 2–2.2 mm.

Phenology. Flowering January to May; collected in fruit in April and June.

Distribution. Known only from the município of Grão-Mogol and surroundings, in the state of Minas Gerais. Occurring in campo rupestre vegetation between 900 and 1250 m, and in cerrado vegetation at 830 m.

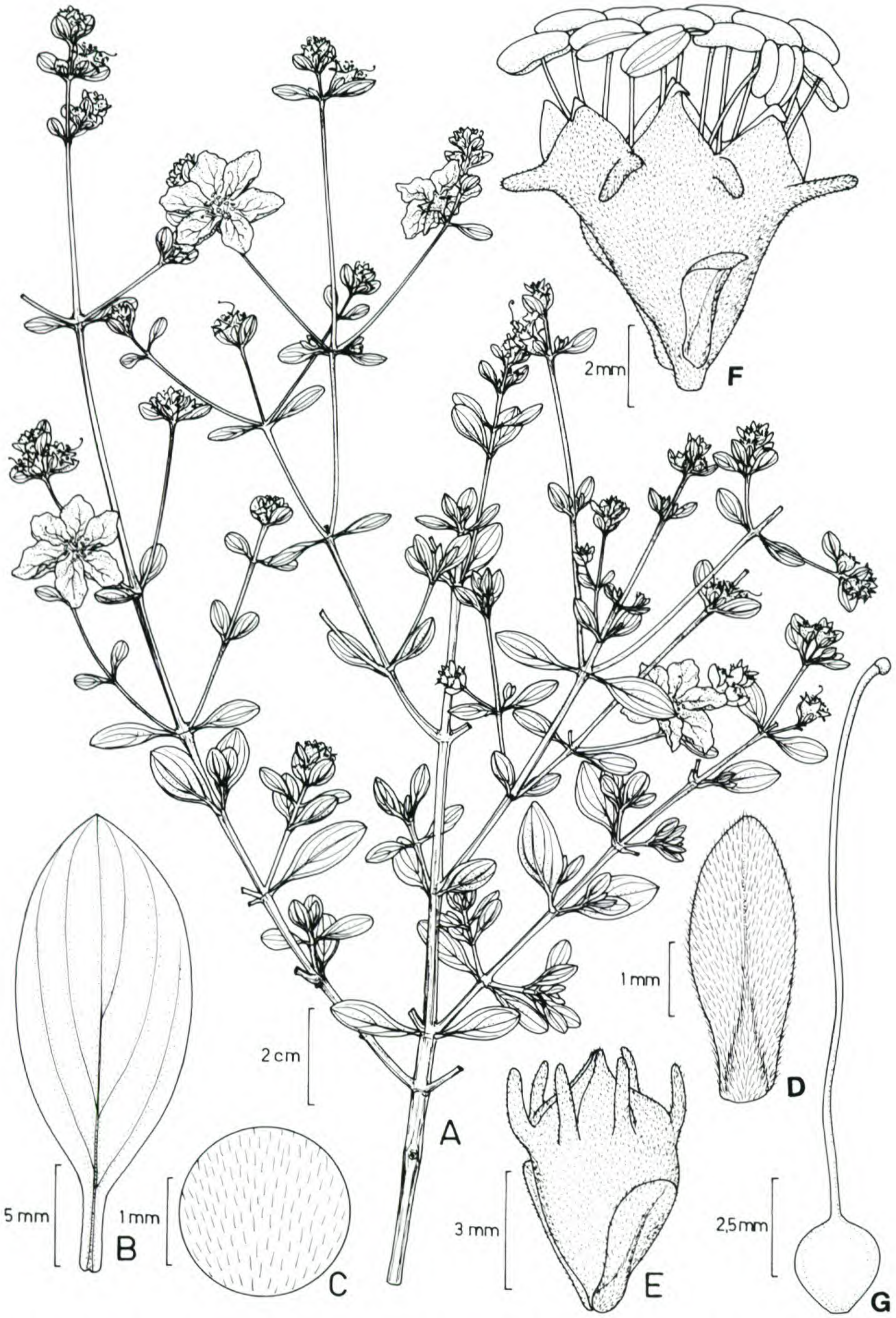


Figure 1. *Diplusodon aggregatifolius* T. Cavalcanti. —A. Branch of the inflorescence. —B. Leaf, adaxial surface. —C. Detail of leaf indument. —D. Bracteole, adaxial surface. —E. Bud. —F. Flower, without petals. —G. Pistil.

Diplusodon aggregatifolius can be easily distinguished by the small elliptical leaves to 3 cm long with attenuate bases and by the pubescent stems, leaves, and flowers. The inflorescence is open and sometimes develops accessory branches, and the flowers have 12 stamens.

Paratypes. BRAZIL. **Minas Gerais:** Grão-Mogol, arredores, 23 Apr. 1978, *Hatschbach 41409* (MBM); próxi-

mo a Grão-Mogol, 12 Apr. 1981, *Furlan et al. (CFCR) 7471* (K, F, SPF); atrás da cidade, 13 Apr. 1981, *Cordeiro et al. (CFCR) 776* (SPF, UB); em direção nordeste da cidade, 16°32′S, 42°55′W, 22 May 1982, *Giulietti et al. (CFCR) 3423* (G, R, SPF); Vale do Ribeirão dos Bois, 21 May 1987, *Mello-Silva & Pirani (CFCR) 10763* (K, SP, SPF), 22 May 1987, *Pirani & Mello-Silva 10811* (K, R, SPF); na saída da cidade em sentido ao Rio Ventania, córrego dos Bois, 16°34′S, 42°54′W, 18 Feb. 1989, *Cavalcanti et al. 278* (CEN, MBM, NY, SPF, UEC); Trilha dos garimpeiros, 14 June 1990, *Hatschbach & Nicolack 54290* (MBM); estrada Grão-Mogol–Cristália, 14 Apr. 1981, *Pirani et al. (CFCR) 904* (BHCB, SPF). **Itacambira:** estrada para Montes Claros, 9 Jan. 1986, *Cordeiro et al. (CFCR) 9122* (K, SPF).

Diplusodon alatus T. Cavalcanti, sp. nov. TYPE: Brazil. Goiás: Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, na margem da cerca próximo à sede do IBDF, 14 Aug. 1991, *Cavalcanti et al. 850* (holotype, CEN; isotypes, K, MBM, NY, SPF). Figure 2.

Diplusodon alato iam floribus 7 cm diam., 32–38-staminibus statim recognoscitur. A *D. sordido* Koehne caule alato et foliis maioribus, glaucis, craspedodromis amplexicaulibusque differt.

Subshrubs 1–1.5 m, glabrous, branchlets subquadrangular, wine-colored to brownish, winged, the wing 1.5–2 mm wide; internodes 2–5 cm long. Leaves amplexicaulous, sessile, completely clasping the stem; venation craspedodromous; blades coriaceous, glaucous, oblong, oblanceolate, or rarely ovate, 3–9 × 2–4 cm, apex acute to obtuse, margin plane, base retuse to subcordate, lateral veins 15–27, inconspicuous. Inflorescences frondose, diplobotrys; flowers crowded on pedicels 1–2 mm long; bracteoles 5–9 × 2–5 mm, oblanceolate, reaching to the apex of the floral tube. Floral tubes 6–7 mm long, 1–2 mm wide, very fleshy, campanulate, enlarging and becoming very hard in fruit; sepals fleshy, 7–8 mm long; appendages 3–4 mm long, narrowly triangular, spreading to suberect; corolla 7 cm diam., petals pink, 30–35 × 20–22 mm, apex obtuse; stamens 32–38(–40), included; ovary glabrous, obconic, 3 × 6 mm; style 17 mm long; ovules ca. 35. Capsules rounded; seeds 37–46, 3.5–4 × 3–3.5 mm.

Phenology. Flowering in May; collected in fruit in February and October.

Distribution. Known only from the Chapada dos Veadeiros, Goiás, area, which has a largely endemic flora particularly rich in Velloziaceae, Poaceae, Xyridaceae, and Cyperaceae; in fields with rocks and white sands in the high plateau areas, 1000–1300 m.

This new species has a remarkable robust, ornamental habit, marked by brownish branchlets that are conspicuously 4-winged. The leaves are large and glaucous, to 9 cm long, completely amplexicaulous and with many lateral veins. The flowers are the largest known for the genus at 7 cm in diameter, with nearly 40 included stamens. The floral tube, epicalyx, and sepals are fleshy; in fruit the sepals become incurved and fruits become very hard. *Diplusodon alatus* has been found growing within an area of 5 m² with *D. argenteus*, *D. oblongus* var. *ciliatus*, and *D. sordidus*.

Paratypes. BRAZIL. **Goiás:** Município de Alto Paraíso de Goiás, Chapada dos Veadeiros, estrada Alto Paraíso–Colinas do Sul, a 28 km do entroncamento da GO-118, 14°08′06″S, 47°44′04″W, 2 Apr. 1997, *Cavalcanti et al. 2186* (CEN, KE, NY); Parque Nacional da Chapada do Veadeiros, próximo ao rio José Jacó, 14 May 1986, *Romaniuc-Neto et al. 449* (G, SP); Parque Nacional da Chapada do Veadeiros, 14°08′S, 47°31′W, 9 May 1987, *Menezes 1208* (SPF); Parque Nacional da Chapada do Veadeiros, entre São Jorge e Rio Preto, 19 Oct. 1990, *Hatschbach et al. 54781* (MBM); estrada para Colinas, a 34 km do entroncamento, 15 Aug. 1990, *Cavalcanti et al. 681* (CEN); cerca 1 km da sede do Parque Nacional da Chapada do Veadeiros, 7 Feb. 1987, *Pirani et al. 1751* (K, SPF); Fazenda Mato Fundo, 16 Oct. 1990, *Hatschbach et al. 54666* (MBM).

Diplusodon argyrophyllus T. Cavalcanti, sp. nov. TYPE: Brazil. Bahia: Abaíra, Distrito de Catolés, encosta da Serra do Atalho, em frente ao Mendonça, ca. 13°16′S, 41°49′W, 3 Apr. 1992, *Ganev 11* (holotype, SPF; isotypes, HUEFS, K, NY). Figure 3.

Indumento argenteo *D. argenteo* appropinquat, sed foliis ovato-lanceolatis acrodromisque, hypanthio oblongo appendicibus calycis lineari-triangularibus differt.

Subshrubs 1.2 m, branchlets subquadrangular, all parts densely and finely sericeous, the trichomes simple, silvery; internodes 0.9–2 cm long. Leaves petiolate, petioles 3–7 mm long; venation eucamptodromous; blades coriaceous, elliptic to ovate, rarely elliptic-lanceolate, 1.5–4 × 0.8–2 cm, apex acute, minutely acuminate, or rarely obtuse, adaxial surface olive-green, sericeous, with lateral veins furrowed; abaxial surface densely covered by silvery trichomes, with lateral veins (3–)5–7, prominent. Inflorescences frondose, triplobotrys to pleiobotrys; flowers crowded on pedicels 1.5 mm long; bracteoles 5 × 2.2–2.5 mm, spathulate, reaching the apex of floral tube. Floral tubes ca. 4.5 mm long, campanulate, densely covered by silvery trichomes; sepals 1.5–2 mm long; appendages ca. 2 mm long, erect to suberect, reaching the level of sepals; corolla 2.5–3 cm diam., petals rose, 13–14 × 7.5–8.5 mm, apex obtuse; stamens 12, slightly exserted; ovary obconic, glabrous, 2–2.2 × 3–3.2 mm; style 12–13 mm long; ovules 14–15. Mature fruits and seeds unknown.

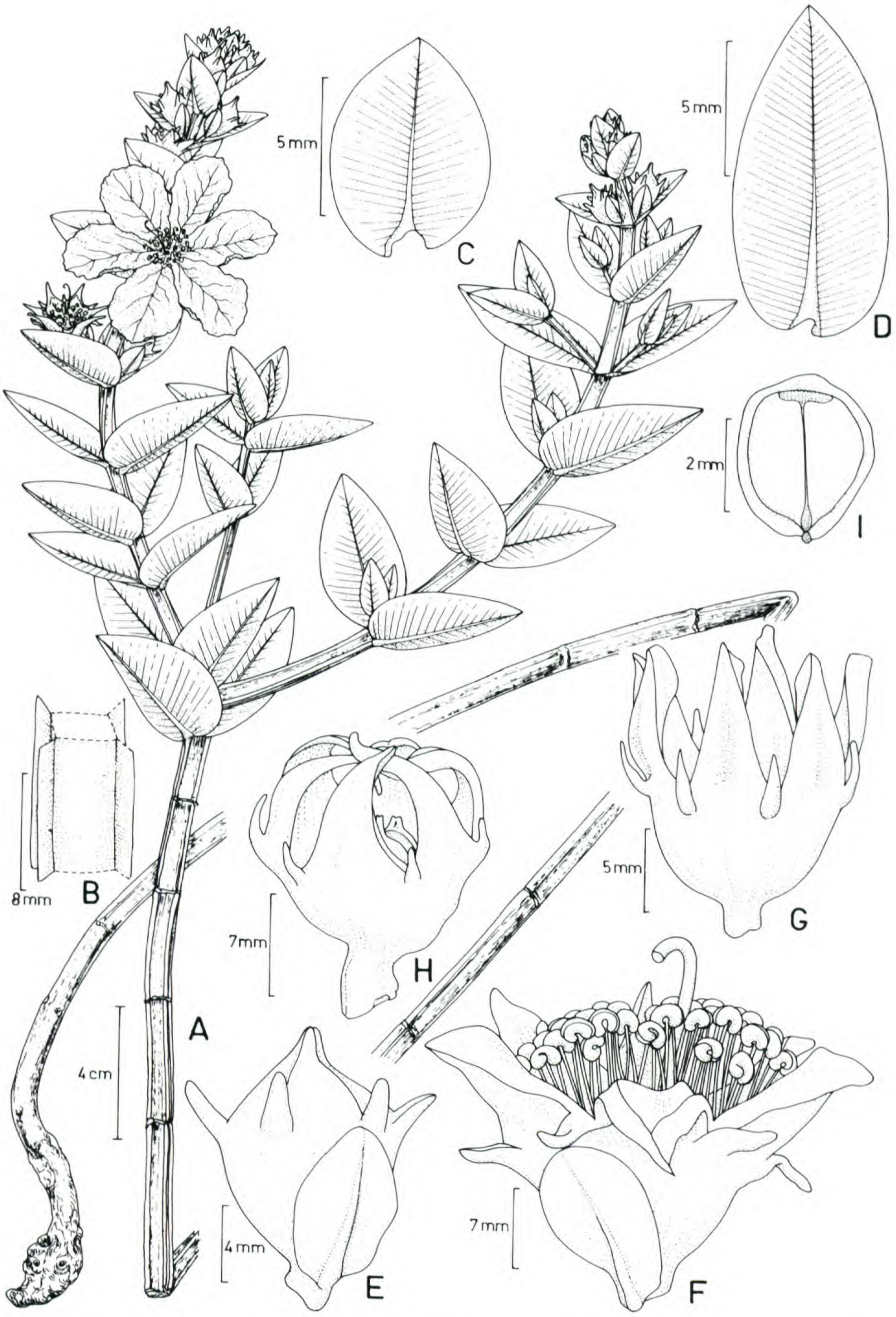


Figure 2. *Diplusodon alatus* T. Cavalcanti. —A. Habit. —B. Section of an internode. —C. Leaf, abaxial surface. —D. Leaf, adaxial surface. —E. Bud. —F. Flower, without petals. —G, H. Persistent floral tube surrounding the mature capsule. —I. Seed.

Figure 3. *Diplusodon argyrophyllus* T. Cavalcanti. —A. Branch of the inflorescence. —B. Section of an internode. —C, D. Leaves, abaxial surface. —E. Detail of leaf indument. —F. Bracteole, adaxial surface. —G. Bud. —H. Flower, without petals. —I. Appendage of epicalyx. —J. Pistil. —K. Ovary, longitudinal section. —L. Trichome of floral tube.

Phenology. Flowering in April.

Distribution. Known only from the type material, collected in Abaíra, Catolés, Bahia; in campo rupestre vegetation, 1100 m.

The habit of *Diplusodon argyrophyllus* is very ornamental because it is completely covered by silvery trichomes, which contrast with the pink flowers. The silvery indument is not common in the

genus, appearing otherwise only in *Diplusodon argenteus*, from Goiás state. The leaves are 4–7 cm long, and the flowers have 12 stamens.

Diplusodon ciliatiflorus T. Cavalcanti, sp. nov. TYPE: Brazil. Goiás: Colinas do Sul, na estrada Colinas do Sul–Usina Hidrelétrica de Serra da Mesa, 23.6 km antes de chegar na entrada da Usina, 14°12′S, 48°04′W, 8 Mar. 1992, *Cavalcanti et al. 1046* (holotype, CEN; isotypes, K, NY, SPF, UB). Figure 4.

Diplusodon thysanosepalo affinis sepalis, segmentis epicalycis prophyllisque dense longeque ciliatis et androecio 20-staminibus distinguitur.

Subshrubs 0.60–2 m, branchlets glabrous, subquadrangular, slightly winged, rust-colored; internodes 1.5–4.5 cm long. Leaves subpetiolate, petioles up to 1 mm long; venation acrodromous; blades coriaceous, glabrous, slightly glaucous, oblong, sometimes brown in dry state, lanceolate to elliptic-lanceolate, the lower ones ovate-oblong, 2.5–6.5 × 1.0–2.7 cm, apex acute to obtuse, sometimes acuminate, margin plane, base obtuse to slightly subcordate, lateral veins 4–5, with 2–4 arising from the base, inconspicuous on the adaxial surface, rust-colored on the abaxial surface. Inflorescences frondose, diplobotrys to triplobotrys; bracts commonly densely ciliate; flowers sessile; bracteoles 7–12 × 3.5–4 mm, elliptic, densely ciliate with long trichomes, reaching to the apex of the floral tube. Floral tubes 7–8 mm long, campanulate, glabrous; sepals with prolonged apex, sparsely ciliate with long trichomes, 5–6 mm long, up to 9 mm long on the fruit; appendages (4–)7–8 mm long, flattened, ciliate with long trichomes, spreading to suberect; corolla 5–7 cm diam., petals lilac to violet, 26–28 × 14–15 mm, apex obtuse; stamens 19–20, exserted; ovary rhombic to obconic, glabrous, slightly furrowed, 2.5–2.8 × 3–3.2 mm; style 20–22 mm long; ovules 34–42. Capsules rounded; seeds 11–36, 3–5 × 4–4.5 mm.

Phenology. Flowering in October to December; collected in fruit in March and December.

Distribution. *Diplusodon ciliatiflorus* occurs in Serra Geral do Paranã, Goiás. The species can be found in dense cerrado with trees and high shrubs, at 730 m, or in open fields at 1400 m.

Diplusodon ciliatiflorus is exceptionally tall for the genus, typically reaching 2 m in height. The flowers are large with ciliated bracteoles, sepals, and appendages, all bearing long trichomes. The rest of the plant is completely glabrous.

The species is closely related to *Diplusodon thysanosepalus*, also from Goiás, which has acrodromous leaf venation and only the sepals and appendages of the epicalyx ciliated. The very open inflorescence of *D. thysanosepalus* and its smaller flowers with 12 stamens also distinguish it from *D. ciliatiflorus*.

Paratypes. BRAZIL. **Goiás:** Minaçu, estrada Serra da Mesa–Colinas do Sul, mais ou menos a 24 km da entrada Sul do Canteiro de Obras da Usina Hidrelétrica de Serra da Mesa, 13°52′S, 48°8′W, 10 Dec. 1991, *Walter et al. 962* (CEN); Alto Paraíso de Goiás, 20 km antes de Colinas, 8 Dec. 1988, *Pereira-Neto 144* (IBGE, SPF); Parque Nacional da Chapada dos Veadeiros, próximo a cachoeira do rio Preto, perto do povoado São Jorge, 6 Feb. 1987, *Pirani et al. 1693* (SPF); entre São Jorge e Rio Preto, 19 Oct. 1990, *Hatschbach & Silva 54783* (MBM); Chapada dos Veadeiros, 3 Nov. 1972, *Rizzo 8560* (UFG); ca. 20 km de Alto Paraíso de Goiás, 20 Mar. 1971, *Irwin et al. 32760* (UB).

Diplusodon mattogrossensis T. Cavalcanti, sp. nov. TYPE: Brazil. Mato Grosso: ca. 270 km N de Xavantina, 8 May 1968, *Ratter et al. 1361* (holotype, UB; isotypes, K, NY). Figure 5H–L.

Diplusodon villosissimo maxime affinis videtur omni ex parte, attamen dimensibus maioribus, praecipue floribus, et numero staminibus ab ea diagnoscitur.

Subshrubs 0.8–1.5 m, branchlets cylindrical, all parts densely covered by long white trichomes; internodes 2–6 cm long. Leaves subpetiolate, petioles 1–2 mm long, villous; venation acrodromous; blades coriaceous, ovate-lanceolate, 4–6 × 2–4.5 cm, apex obtuse, frequently obtuse-acuminate, margin plane, base obtuse to subcordate, surfaces covered by long white trichomes, lateral veins prominent in abaxial surface; lateral veins 4–6, 2–3 arising from the base. Inflorescence frondose, botrys to diplobotrys; rarely triplobotrys; flowers on pedicels 5.5–6.5 mm long; bracteoles 16–17 × 7–8 mm, elliptic-lanceolate, surpassing the apex of floral tube. Floral tubes 8–9 mm long, campanulate, densely covered by trichomes; sepals 5.5–6 mm long; appendages 8.5–9 mm long, erect; corolla 5.5–6 cm diam., petals 23–25 mm long, apex obtuse; stamens 23–24, included; ovary obovate-depressed, glabrous, ca. 4 × 4 mm; style 11–13 mm long; ovules 52–54. Mature fruits and seeds unknown.

Phenology. Flowering in May.

Distribution. *Diplusodon mattogrossensis* was collected in Serra do Roncador, in northeastern Mato Grosso, growing in cerrado vegetation at 500 m.

The habit and some floral characteristics of *Diplusodon mattogrossensis* are similar to those of *D.*

Figure 4. *Diplusodon ciliatiflorus* T. Cavalcanti. —A. Branch of the inflorescence. —B. Section of an internode. —C–F. Leaves, abaxial surface. —G. Flower, without petals. —H. Ovary. —I, J. Bracteoles, abaxial surface. —K. Persistent floral tube surrounding the immature capsule. —L. Immature capsule. —M. Seed.

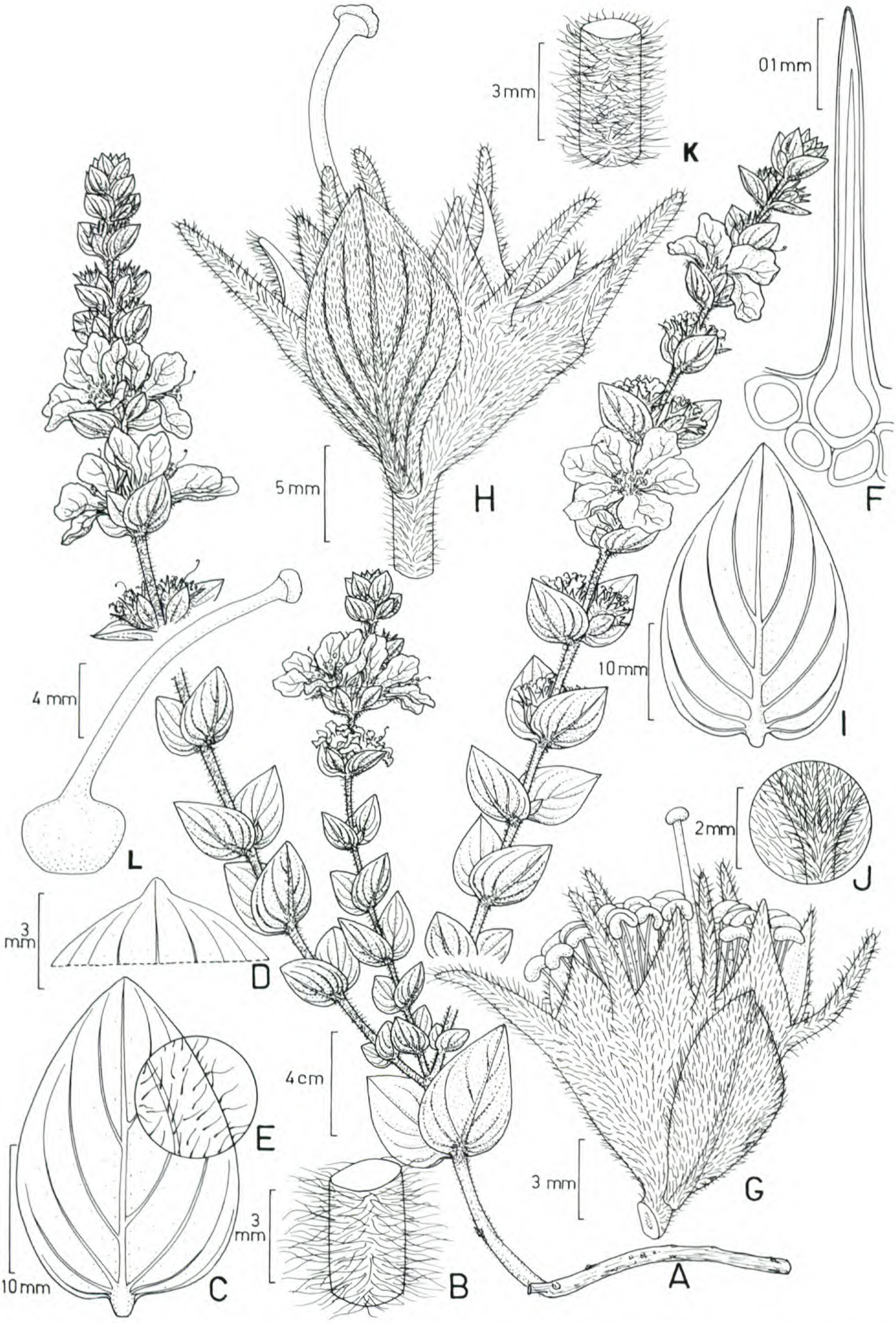


Figure 5. *Diplusodon villosissimus* Pohl. —A. Habit. —B. Section of an internode. —C. Leaf, abaxial surface. —D. Acuminate apex of the leaf. —E. Detail of leaf indument. —F. Trichome of the leaf. —G. Flower, without petals. *Diplusodon mattogrossensis* T. Cavalcanti. —H. Flower, without petals. —I. Leaf, abaxial surface. —J. Detail of leaf indument. —K. Section of an internode. —L. Ovary.

villosissimus (Fig. 5A–G), a species of Minas Gerais and São Paulo states. At first, *D. mattogrossensis* was considered a polyploid representative of *D. villosissimus*, because of the gigantism of some floral parts, which are otherwise similar to those of *D. villosissimus*. However, the species are distinctly allopatric and have different stamen numbers, which leads me to regard *D. mattogrossensis* as a new species.

Paratypes. BRAZIL. **Mato Grosso:** estrada Xavantina–Cachimbo, 200 km de Xavantina, 29 May 1966, *Hunt & Ramos 5661* (K, UB); 12°54′S, 51°52′W, ca. 270 km de Xavantina, Lagoa de Leo, 12°54′S, 51°52′W, 29 May 1968, *Ratter et al. 1574* (K, NY); Serra do Roncador, ca. 160 km N de Xavantina, 27 May 1966, *Irwin et al. 16139* (NY).

Diplusodon oblongus Pohl var. **angustifolius** T. Cavalcanti, var. nov. TYPE: Brazil. Goiás: Alto Paraíso de Goiás, cerca de 5 km depois da entrada para as cachoeiras (Vila São Jorge), 14°8′S, 47°30′W, 8 Mar. 1992, *Cavalcanti et al. 1042* (holotype, CEN).

D. oblongo var. *oblongo* foliis angustis hifodromisque segmentis epicalycis longioribus differt.

Subshrubs 0.4–2 m, branchlets subquadrangular, minutely pilose, the trichomes inconspicuous; internodes 0.5–1 cm long. Leaves sessile, minutely pilose; venation hyphodromous; blades coriaceous, narrowly-oblong, 0.7–3 × 0.3–0.5(–0.8) cm, apex acute, margin plane, thick, base acute, attenuate, lateral veins 0–1(–2), inconspicuous. Inflorescences frondose, triplobotrys to pleiobotrys; flowers sessile; bracteoles 5–6 × 1.5–2 mm, oblong, angled, margin plane, apex strongly acute, base retuse, minutely pilose, reaching the apex of the floral tube, sometimes surpassing it. Floral tubes 5–6.5 mm long, oblong, indument inconspicuous, appearing glabrous, sepals 1.5–2 mm long; appendages 4–5.5 mm long, cylindrical, spreading to suberect; corolla lilac; stamens 12, exserted; style exserted; ovules 14–16. Capsules oblong.

Phenology. Flowering in March. Some fruits found in March.

Distribution. Known only from the type from Chapada dos Veadeiros, Goiás.

This new variety is based on the presence of narrow leaves; the general shape of the leaves of *D. oblongus* var. *oblongus* is ovate to ovate-lanceolate. In addition, the leaves of the new variety are generally hyphodromous, the flowers have angled bracteoles, and the appendages of the epicalyx are longer than in the typical variety, surpassing the sepals by about 3 mm.

Paratypes. BRAZIL. **Goiás:** Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, na margem da cerca, próximo à sede (8 km), 14°12′S, 47°52′W, *Cavalcanti et al. 851* (CEN); Chapada dos Veadeiros, estrada Alto Paraíso–Colinas do Sul, a 28 km do entroncamento da GO-118, 14°10′S, 47°47′W, 2 Apr. 1997, *Cavalcanti et al. 2188* (CEN, KE, NY); Chapada dos Veadeiros, estrada Colinas-GO-118, km 42, GO-327, 14°10′S, 47°44′W, 8 Mar. 1989, *Cavalcanti et al. 401* (CEN); entrada do Parque Nacional da Chapada dos Veadeiros (à esquerda), estrada Alto Paraíso–Colinas do Sul, 34 km da GO 118, 27 Jan. 1997, *Walter et al. 3646* (CEN, SPF).

Diplusodon plumbeus T. Cavalcanti, sp. nov. TYPE: Brazil. Goiás: Cristalina, a 5 km N de Cristalina, 17 Apr. 1994, *Cavalcanti & Ayres 1267* (holotype, CEN; isotypes, F, K, MBM, NY, R, SPF). Figure 6.

Foliis lanceolatis acrodromisque *D. helianthemifolio* var. *pemphoideo* appropinquat, sed hypanthio frutuque oblongis differt.

Subshrubs 0.4–1.2 m, branchlets cylindrical, covered by stellate trichomes; internodes 0.3–1 cm long. Leaves sessile; venation acrodromous; blades coriaceous, narrowly lanceolate, 0.6–2 × 0.3–0.6 cm, apex acute, margin revolute, base ovate, adaxial surface glabrous, shining, dark gray in dry state, abaxial surface with dense, white trichomes, lateral veins furrowed, 4–5, 2–3 arising from the base, very close to each other, almost parallel, glabrous, rust-colored in dry state. Inflorescences frondose, triplobotrys; flowers subsessile; bracteoles 4–4.5 × 2.2–2.5 mm, elliptic to obovate with margin plane, almost glabrous, reaching the apex of the floral tube, sometimes surpassing it. Floral tubes 4–5 mm long, reddish, wine to brown in fruit, oblong, indument inconspicuous, appearing glabrous; sepals 2–2.5 mm long; appendages of the epicalyx 2–2.5 mm long, cylindrical, spreading; corolla 3–3.5 cm diam., petals pink, 15–17 × 10–12 mm; stamens 12, exserted; ovary obconic, glabrous, 1.5–1.8 × 2–2.5 mm; style 10–12 mm long; ovules 15–21. Capsules oblong; seeds 5–13, 2.5–3 × 2–2.5 mm.

Phenology. Flowering January to March. Collected in fruit in April and November.

Distribution. *Diplusodon plumbeus* was found in the município of Cristalina, Goiás, in cerrado and campo rupestre vegetation with rock outcroppings, 1070–1250 m.

Diplusodon plumbeus is characterized by narrowly lanceolate leaves and acrodromous venation with the lateral veins very close and almost parallel. The leaves are discolorous with the adaxial surface glabrous, bright dark-green in nature and dark gray in

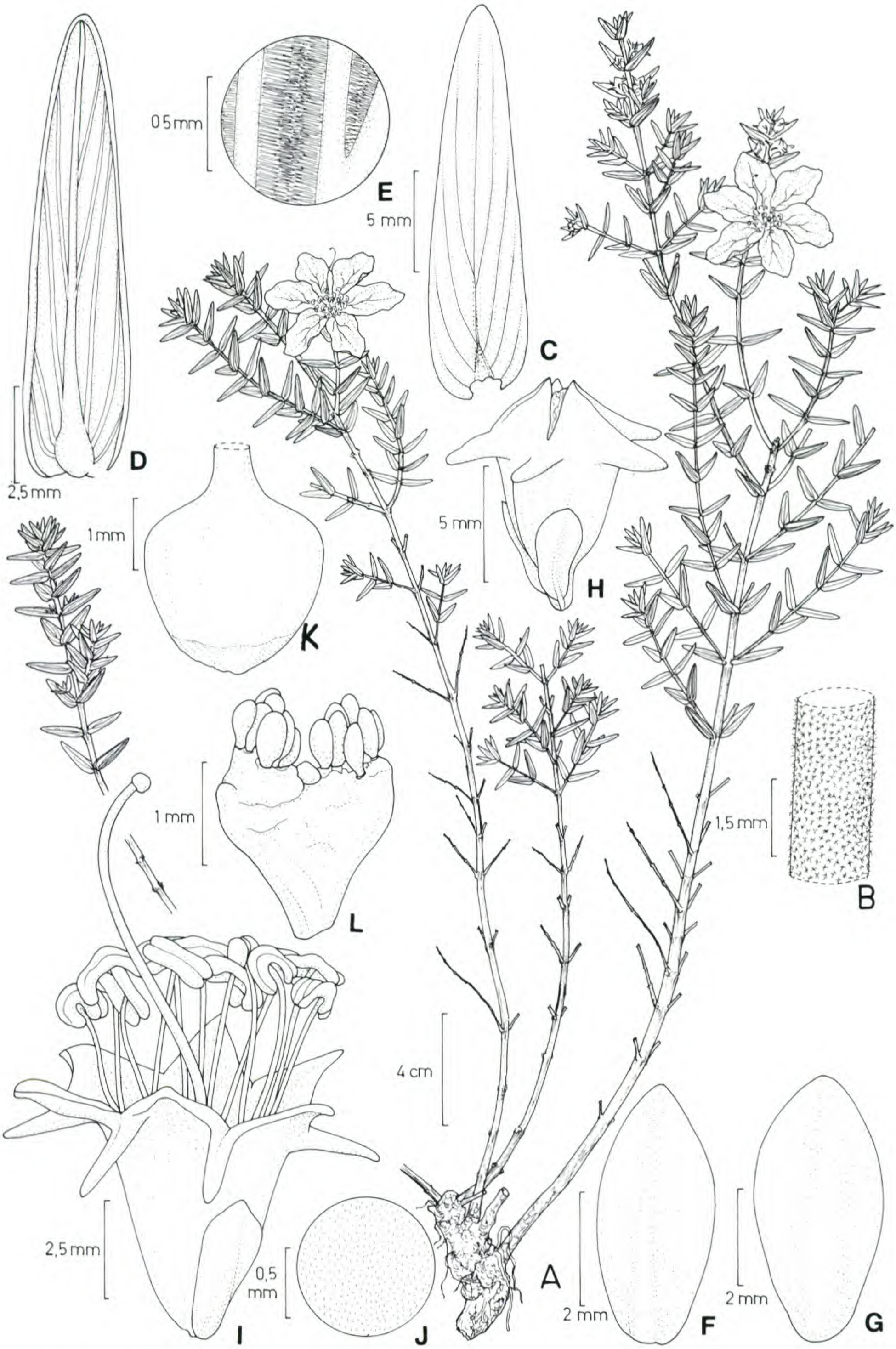


Figure 6. *Diplusodon plumbeus* T. Cavalcanti. —A. Habit. —B. Section of an internode. —C. Leaf, adaxial surface. —D. Leaf, abaxial surface. —E. Detail of leaf indument. —F, G. Bracteoles, adaxial surface. —H. Bud. —I. Flower, without petals. —J. Detail of floral tube indument. —K. Ovary. —L. Placenta.

the dry state. The abaxial surface is very white with stellate trichomes, which are absent on the veins. A very peculiar characteristic of *D. plumbeus* and a small number of other species in the genus is the oblong floral tube that is slightly narrowed in the apex.

Diplusodon helianthemifolius var. *pemphoides* is closely allied but differs by the lanceolate shape of the leaves, acrodromous venation, with 2–3 lateral veins not close or parallel and covered by stellate trichomes. The variety also differs from *D. plumbeus* by its small flowers with a campanulate floral tube, the appendages of the epicalyx deflexed, and a rounded capsule.

Paratypes. BRAZIL. **Goiás:** Cristalina, BR-040, Brasília–Cristalina, km 102, 16°48′S, 47°37′W, 12 Mar. 1989, *Cavalcanti et al. 411* (CEN, SPF); estrada para Salto do Arrojado, 10 Feb. 1990, *Hatschbach et al. 53751* (MBM); Serra do Cristais, 21 Feb. 1975, *Hatschbach et al. 36396* (MBM); 3 km N de Cristalina, 2 Mar. 1966, *Irwin et al. 13258* (NY, UB); ca. 5 km da cidade, na estrada para Paracatu, 16°46′S, 47°37′W, 4 Feb. 1987, *Pirani et al. 1512* (CEN, F, K, MBM, NY, SPF, UB); 5 km S de Cristalina, 1 Nov. 1965, *Irwin et al. 9737* (NY).

Diplusodon pygmaeus T. Cavalcanti, sp. nov. TYPE: Brazil. Goiás: Alto Paraíso de Goiás, estrada vicinal à esquerda, a 5 km S de Alto Paraíso de Goiás no sentido Brasília, GO-118, Serra da Baliza, no topo do morro, 14°11′S, 47°45′W, 15 Mar. 1995, *Cavalcanti et al. 1363* (holotype, CEN, isotypes, F, K, MBM, NY, SPF). Figure 7.

Habitu pro genera minimo inter affines facile recognoscitur.

Diminutive subshrubs, 3–11 cm, caespitose, branchlets cylindrical, wine-colored, subsericeous, covered by white trichomes; internodes 0.5–1.5 cm long. Leaves petiolate, petioles 1–2 mm long; venation acrodromous, reticulate; blades subcoriaceous, with sparse, white trichomes, ovate to elliptic, 1.0–2.5 × 0.7–1.5 cm, apex obtuse, slightly acuminate, margin plane, ciliate, base obtuse to subcordate, lateral veins prominent, 3–4, 2 arising from the base, tertiary veins conspicuous. Inflorescences frondose, botrys; flowers on pedicels 1–3 mm long; bracteoles 7–8 × 2–3 mm, elliptic, apex acute, margin plane, base acute, reaching the midpoint or up to the apex of floral tube, sometimes surpassing it. Floral tubes 9–10 mm long, base green, apex wine-colored, narrowly oblong, sericeous; sepals ciliate, sericeous, 4–5 mm long; appendages of the epicalyx wine-colored, sericeous, 4–5 mm long, cylindrical, erect; corolla 3 cm diam., petals pink, obovate; stamens 12, included; ovary obovate, glabrous, 3.5–4 × 2.5–3 mm; style 12–13 mm long; ovules 11–14. Capsules oblong in immature state; seeds unknown.

Phenology. Flowering in March.

Distribution. Known only from Serra da Baliza, Chapada dos Veadeiros, Goiás, collected in a grassy field, rocky soil; 1500 m.

The specific epithet was chosen in reference to the unique diminutive habit of this species. The individuals have short vegetative branches and a large, hard, underground xylopodium. The flowers are the size typical of most species of the genus, but the shape of the floral tube is rare, being narrow and oblong. The capsules are also oblong, rather than globose as is more common in the genus.

Paratype. BRAZIL. **Goiás:** Alto Paraíso de Goiás, Chapada dos Veadeiros, estrada de terra a leste, subindo na Serra da Baliza, nas terras do Sr. Paulo, no alto do morro, perto da casinha abandonada, 14°09′35″S, 47°28′83″W, 2 Apr. 1997, *Cavalcanti et al. 2194* (CEN, KE, NY).

Diplusodon trigintus T. Cavalcanti, sp. nov. TYPE: Brazil. Tocantins: Ponte Alta do Norte, de Porto Nacional para Ponte Alta do Norte, 20 km de Ponte Alta, 13 June 1974, *Rizzo 9904* (holotype, UFG). Figure 8.

Ab omnibus speciebus generis segmentis epicalycis prophyllisque valde redactis et floribus 30–32-andris optime distincta.

Glabrous subshrubs, ca. 0.8 m, branchlets subquadrangular, slightly winged, reddish; internodes 1.5–2 cm long. Leaves sessile; venation acrodromous, reticulate; blades coriaceous, glaucous, ovate-lanceolate, 1.5–2.5 × 1.0–1.8 cm, apex acute, margin plane, base obtuse, lateral veins 3–4. Inflorescences frondose-bracteose, diplobotrys; flowers on pedicels 6–7 mm long, persistent; bracteoles 1.5–2 × 1–1.1 mm, oblong to elliptic, margin plane, apex obtuse, base retuse, reaching just to the base of floral tube. Floral tubes 4–5 mm long, campanulate; sepals 2.5–3 mm long; appendages 0.3–0.5 mm long, spreading; corolla violet; stamens 30–32, slightly exserted; ovary rhombic, glabrous, 2–2.2 × 3–3.5 mm; style 14–15 mm long; ovules ca. 16. Capsules rounded; seeds ca. 4, 2–2.5 × 2–2.2 mm.

Phenology. Flowering in June.

Distribution. Known only from the type material, collected at Ponte Alta do Norte, state of Tocantins, in cerrado vegetation.

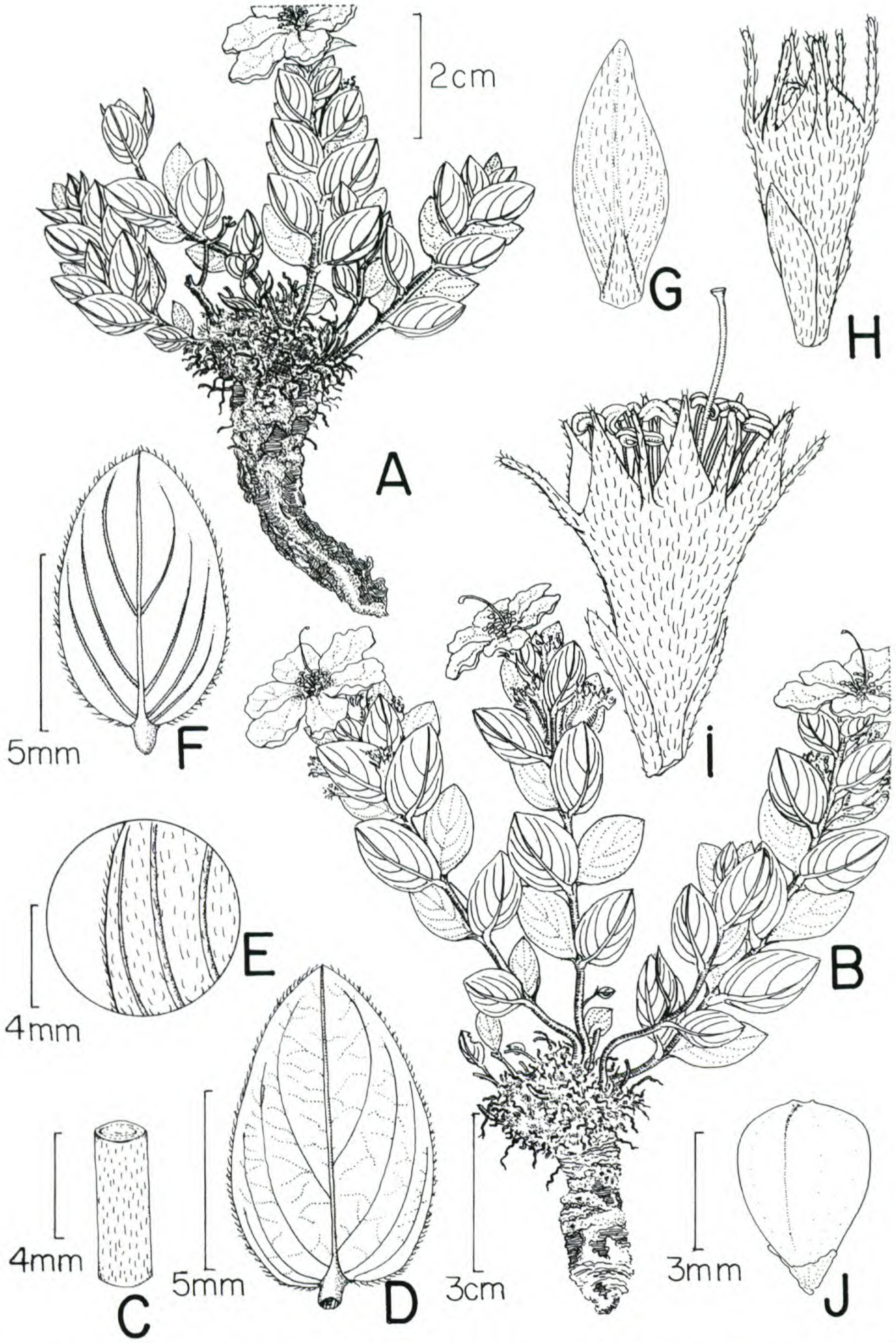


Figure 7. *Diplusodon pygmaeus* T. Cavalcanti. —A, B. Habit. —C. Section of an internode. —D. Leaf, abaxial surface. —E. Detail of leaf indument. —F. Leaf, abaxial surface. —G. Bracteole, adaxial surface. —H. Bud. —I. Flower, without petals. —J. Immature capsule.

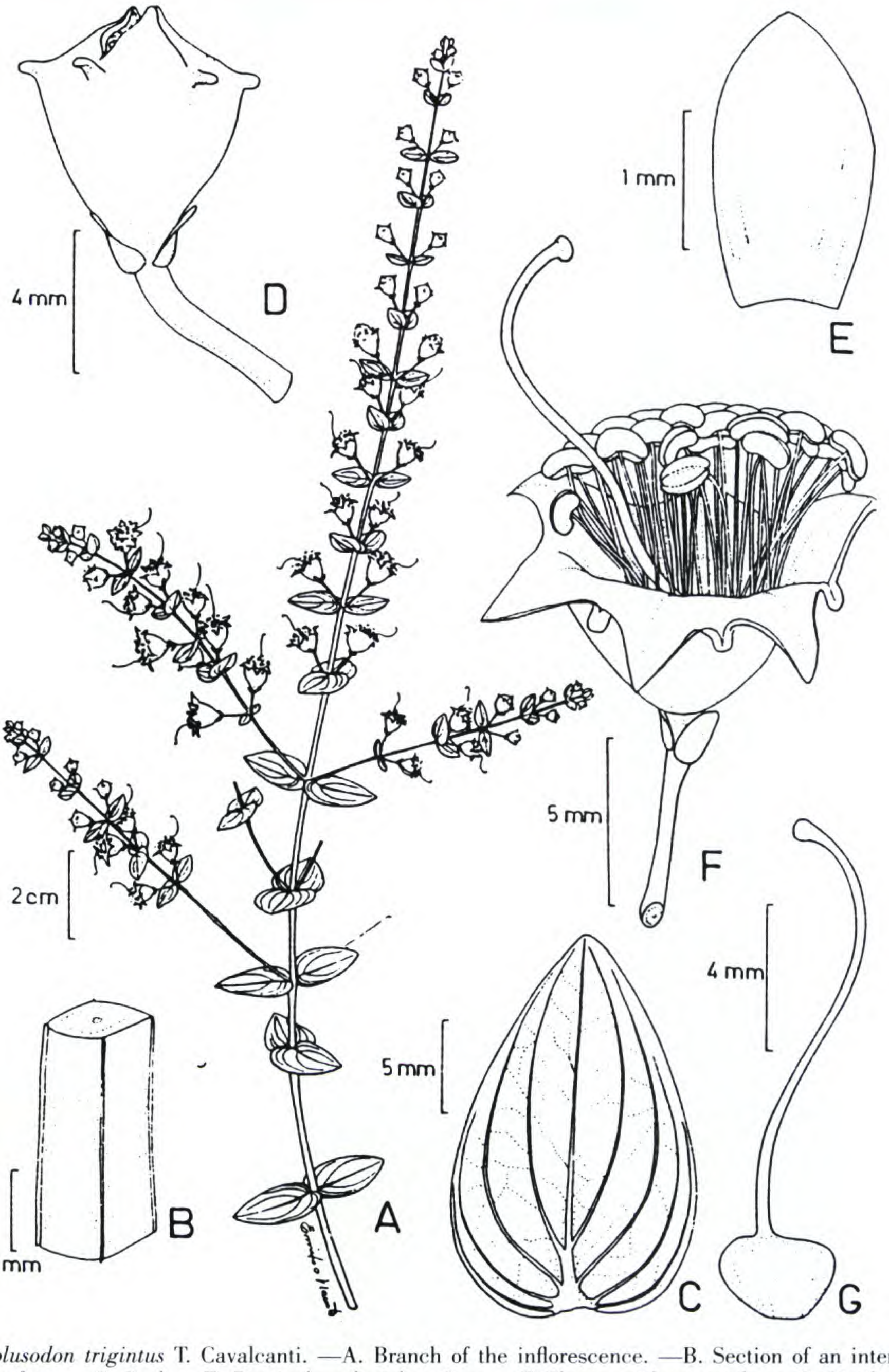


Figure 8. *Diplusodon trigintus* T. Cavalcanti. —A. Branch of the inflorescence. —B. Section of an internode. —C. Leaf, abaxial surface. —D. Bud. —E. Bracteole, adaxial surface. —F. Flower, without petals. —G. Pistil.

Diplusodon trigintus has ovate-lanceolate leaves, with acrodromous venation and conspicuous second and third lateral veins. The main characteristics are the very small prophylls, which do not reach the floral tube, persistent pedicels, reduced appendages, and 30–32 stamens. The habit is similar to *D. rotundifolius*, from Minas Gerais, but the flower of *D. rotundifolius* has 12 stamens and large prophylls that cover the entire floral tube.

Diplusodon ulei Koehne var. **ciliatus** T. Cavalcanti, var. nov. TYPE: Brazil. Bahia: Lençóis, arredores da cidade, July 1992, *Cavalcanti & Ayres 1260* (holotype, CEN; isotypes, NY, SPF). Figure 9H–N.

Proxime affinis est *D. ulei* var. *ulei*, a qua segmentis epicalycis sepalisque brevioribus et inflorescentia thyrsoidea differt.

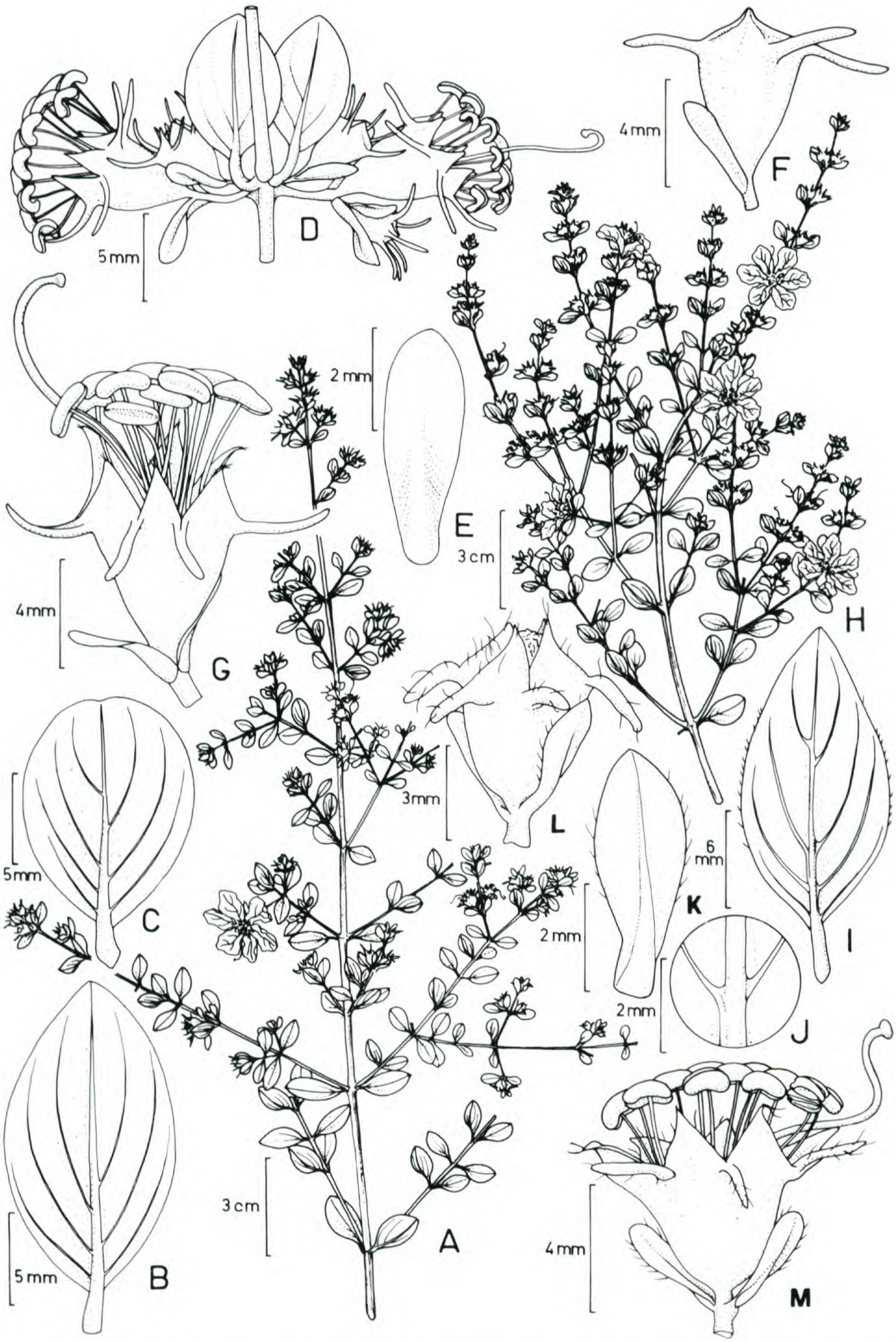


Figure 9. *Diplusodon ulei* var. *ulei*. —A. Branch of the inflorescence. —B, C. Leaves, abaxial surface. —D. Detail of inflorescence (cyme). —E. Bracteole, adaxial surface. —F. Bud. —G. Flower, without petals. *Diplusodon ulei* var. *ciliatus*. —H. Branch of the inflorescence. —I. Leaf, abaxial surface. —J. Detail of the leaf. —K. Bracteole, adaxial surface. —L. Bud. —M. Flower, without petals.

Subshrubs 1–2 m, branchlets quadrangular, glabrous; internodes 0.8–2.5 mm long. Leaves petiolate, petioles 3–5 mm long; venation eucamptodromous; blades chartaceous, ovate-elliptic, rarely obovate, 1.0–3.5 × 0.5–2.3 cm, apex acute, margin plane to slightly revolute, ciliate, base acute, rarely obtuse; abaxial surface with 3–5 prominent lateral veins; domatia visible. Inflorescence frondose to frondose-bracteose, diplobotrys to triplobotrys to thyrse, with accessory branches; pedicels 2.5–3.5 mm long; bracteoles 3.5–4.4 × 1.5–2 mm, spatulate, ciliate, reaching from the midpoint to the apex of floral tube. Floral tubes 4.5–5 mm long, campanulate, wine to dark wine; sepals violet, ciliate, 3.5–4 mm long; appendages flat, ciliate, 3.0–3.5 mm long, spreading to slightly deflexed; corolla pink, 2.5–3 cm diam., petals 12–15 × 8–10 mm, apex obtuse; stamens 12, exserted; style 11–14 mm long; ovary rhombic to obconic, glabrous, 2–2.2 × 2.5 mm; ovules 14–17. Mature fruits and seeds unknown.

Phenology. Flowering in April to June; collected in fruit in July.

Distribution. *Diplusodon ulei* var. *ciliatus* was found in the mountains of Chapada Diamantina, Bahia, municípios of Andaraí, Lençóis, and Mucugê, in rock outcrops of campo rupestre vegetation, 800–1000 m.

Diplusodon ulei var. *ciliatus* is distinguished by its ovate-elliptic leaves with acute apexes and thin, ciliate margins, and by the lateral veins prominent on the abaxial surface. Bracteoles, sepals, and appendages are ciliate and shorter than *D. ulei* var. *ulei.* The inflorescence, presenting cymes of triads, is a thyrse. *Diplusodon ulei* var. *ulei* (Fig. 9A–G) is totally glabrous, has orbiculate to ovate leaves with the apex generally obtuse, a thickened margin, and inconspicuous lateral veins on both surfaces. The inflorescence has accessory branches.

Paratypes. BRAZIL. **Bahia:** Andaraí, rodovia Andaraí–Mucugê, km 30, 20 May 1989, *Mattos-Silva et al. 2808* (CEPEC); Lençóis, BR-242, ca. 15 km NW de Lençóis, km 225, 10 June 1981, *Mori & Boom 14260* (CEPEC, K, NY), *Mori & Boom 14289* (K, NY); ca. 5 km N de Lençóis, 13 June 1981, *Mori & Boom 14404* (CEPEC, K, NY); caminho de Lençóis para Barro Branco, ca. 8 km de Lençóis, 27 Apr. 1992, *Queiróz et al. 2754* (CEPEC, HUEFS); Morro do Pai Inácio, BR-242 W de Lençóis, km 232, 12 June 1981, *Mori & Boom 14373* (CEPEC, K, NY).

Acknowledgments. I thank Renato Mello Silva, of the University of São Paulo, for providing the Latin diagnoses, and Shirley Graham, of Kent State University, for helpful comments and review of the English. This article is part of my doctoral dissertation developed at the University of São Paulo, SP, Brazil.

Literature Cited

Cavalcanti, T. B. 1987. Lythraceae. *In*: A. M. Giulietti, N. L. Menezes, J. R. Pirani, M. Meguro & M. G. L. Wanderley, Flora da Serra do Cipó, Minas Gerais: Caracterização e lista de espécies. Bolm. Botânica Univ. S. Paulo 9: 66–67.

———. 1988. A família Lythraceae na Serra do Cipó, Minas Gerais, Brasil. Master's Thesis, Biosciences Institute, University of São Paulo, SP, Brazil.

———. 1989. *Cuphea rubro-virens* T. Cavalcanti, nova espécie de Minas Gerais, Brasil, e nota sobre *C. teleandra* Lourt. Bolm. Botânica Univ. S. Paulo 11: 71–76.

———. 1990. Flora da Serra do Cipó, Minas Gerais. Lythraceae. Bolm. Botânica Univ. S. Paulo 12: 67–93.

———. 1991. New species of *Cuphea* (Lythraceae) from Brazil. Kew Bull. 46: 253–268.

———. 1995. Revisão de *Diplusodon* Pohl (Lythraceae). Doctoral Dissertation, University of São Paulo, São Paulo, SP, Brazil.

——— & S. Graham. 1996. *Diplusodon bolivianus* sp. nov. (Lythraceae), the first report of the genus for Bolivia. Novon 6: 253–255.

Koehne, E. 1903. Lythraceae. *In:* A. Engler (editor), Das Pflanzenreich IV. 216: 1–326. Engelmann Verlag, Leipzig.

Lourteig, A. 1989. Lythraceae Austroamericanae. Addenda et corrigenda III. Bradea 5(19): 205–241.

Ramos, L. C., W. Roath, T. B. Cavalcanti & J. H. Kirkbride, Jr. 1992. *Cuphea* (Lythraceae) Descriptors. Iowa State Univ. Press, Staff Report.

A New Combination and a New Synonym in *Vigna* (Fabaceae: Phaseoleae) for the *Flora de Nicaragua*

Alfonso Delgado-Salinas

Departamento de Botánica, Instituto de Biología, UNAM, Apdo. Postal 70-367, C.P. 04510, México, D.F., Mexico

ABSTRACT. A survey of all available material demonstrates conclusively that *Phaseolus spectabilis* is clearly a *Vigna*, and thus the new combination *Vigna spectabilis* (Standley) A. Delgado is proposed. This species is placed next to *V. linearis* in the New World subgenus *Sigmoidotropis*, section *Caracallae*. In addition, *Phaseolus stenolobus* is reduced to the synonymy of *Vigna linearis* var. *latifolia* (Bentham) Maréchal.

While preparing treatments of *Phaseolus* L. and *Vigna* Savi for the *Flora de Nicaragua*, and as part of a monographic project involving *Vigna*, I have encountered several specimens that are identified as *Phaseolus spectabilis*, using Standley and Steyermark's (1946) *Flora of Guatemala*. Because this species lacks apomorphies diagnostic of *Phaseolus* (i.e., hooked hairs in its indumentum, inflorescences with unswollen nodes, a tightly coiled lateral keel) and has those diagnostic of New World species of *Vigna* subg. *Sigmoidotropis*, sect. *Caracallae* sensu Maréchal et al. (1978) (i.e., inflorescences with conspicuous swollen nodes, a loosely coiled keel, pods straight and compressed), the necessary new combination is made here.

Vigna spectabilis (Standley) A. Delgado, comb. nov. Basionym: *Phaseolus spectabilis* Standley, Contr. U.S. Natl. Herb. 17: 430, plate 25. 1914. TYPE: Guatemala. Alta Verapaz: vicinity of Secanquím, 550 m, 7 May 1905, *H. Pittier 281* (holotype, US).

Along with the publication of *Phaseolus spectabilis*, Standley (1914) published the morphologically similar species *P. stenolobus*. This plant inhabits mainly montane forests from Mexico to Panama (occasionally also in South America), and may occur in localities next to the ones of *Vigna spectabilis*. The characters Standley used to distinguish these plants are that *P. stenolobus* has narrower calyx lobes and bracts, and a different pubescence on its leaflets. According to Maréchal et al. (1978), *Phaseolus stenolobus* may be recognized as *Vigna linearis* var. *latifolia*, a poorly defined variety that is distinguished from the widespread typical variety by its broader leaflets. All evidence suggests that *P. stenolobus* cannot be kept specifically distinct, and its proposed synonymy is the following:

Vigna linearis var. **latifolia** (Bentham) Maréchal, Mascherpa & Stainier, Taxon 27: 202. 1978. *Phaseolus linearis* var. *latifolius* Bentham, in Martius, Fl. Bras. 15(1): 187. 1859. TYPE: Brazil. [Minas Gerais]: "Prov. Minarum," *A. F. Regnell [78]* (holotype, K not seen; phototype, NY).

Phaseolus stenolobus Standley, Contr. U.S. Natl. Herb. 17: 431. 1914. Syn. nov. TYPE: Guatemala. Santa Rosa: Cerro Redondo, 1500 m, Oct. 1983, *J. D. Smith 6135* (holotype, US).

Vigna spectabilis is easily distinguished from *V. linearis* (including *P. stenolobus*) by its large foliaceous lateral and ventral calyx lobes (ca. 1.2 cm long, 3 mm wide), as opposed to the triangular and slightly falcate lobes (ca. 6 mm long, 1 mm wide) in *V. linearis*. It also differs by its blue or lavender flower (ca. 3 cm), with the keel incurved and loosely coiled distally (with coils ca. 8 mm diam.); this portion of the keel rotates in anthesis toward the front (facing the observer). In *V. linearis*, the flower is approximately 2 cm long, and its keel has two loosely coils about 4 mm in diameter, also with a rotation toward the front. Further, *V. spectabilis* has triporate pollen grains that are oblate, unlike the unique subprolate and biporate pollen of *V. linearis* (Stainier & Horvat, 1983).

Vigna spectabilis occurs in understory or grassy openings of evergreen, pine-oak, and pine forests or vegetation derived from these, in southern Mexico (Oaxaca, Chiapas), Belize, Guatemala, Honduras, Nicaragua, and Costa Rica, ranging from 150 to 2000 m.

Acknowledgments. I am indebted to the curators of the following herbaria: CAS, DH, MEXU, MICH, MO, NY, US. I am grateful to Matt Lavin and David A. Neill for comments on the manuscript

and to Leticia Torres Colín and Sara Fuentes Soriano for providing the pollen information.

Literature Cited

Maréchal, R., J.-M. Mascherpa & F. Stainier. 1978. Étude taxonomique d'un groupe complexe d'espèces de genres *Phaseolus* et *Vigna* (Papilionaceae) sur la base de données morphologiques et polliniques, traitées par l'analyse informatique. Boissiera 28: 1–273.

Stainier, F. & F. Horvat. 1978. L'étude de l'exine dans le complexe *Phaseolus–Vigna* et dans genres apparentés.V. Le sous-genre *Sigmoidotropis* (Piper) Verdcourt et *Ramirezella strobilophora* (Robinson) Rose. Pollen & Spores 25: 5–40.

Standley, P. C. 1914. Studies of tropical American phanerogams—No. 1. Contr. U.S. Natl. Herb. 17: 427–458.

——— & J. A. Steyermark. 1946. Flora of Guatemala. Part V. Fieldiana: Botany 24: 1–502.

New Species of *Ribes* (Grossulariaceae) from South America

Alina Freire-Fierro
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.
E-mail: freire@mobot.mobot.org

ABSTRACT. Two new Andean species from Ecuador and Colombia are described in the genus *Ribes*. *Ribes erectum* is a shrubby species characterized by elliptic and mostly unlobed leaves, sessile glands, erect inflorescences, cup-shaped flowers, and ovaries with only sessile glands. *Ribes austroecuadorense* is characterized by ovate and 3-lobed to 3-cleft leaves, erect inflorescences, cup-shaped flowers, and pubescent ovaries. Both species are illustrated and discussed in a systematic context.

RESUMEN. Se describen dos especies nuevas andinas del género cosmopolita *Ribes* provenientes de Ecuador y Colombia. *Ribes erectum* es una especie arbustiva que se caracteriza por sus hojas elípticas y enteras, glándulas sésiles, inflorescencias erectas, flores cupuliformes y ovario únicamente con glándulas sésiles. *Ribes austroecuadorense* se caracteriza por sus hojas ovadas y 3-lobadas a 3-divididas, inflorescencias erectas, flores cupuliformes y ovarios densamente pubescentes. Ambas especies son ilustradas y discutidas en un contexto sistemático.

The genus *Ribes* includes seven subgenera and 150 species (Janczewski, 1907; Valsecchi, 1977). During work on the Saxifragaceae for the *Flora of Ecuador* (Freire-Fierro, in prep.), at least two new species were discovered. *Ribes erectum* and *Ribes austroecuadorense* belong to the subgenus *Parrilla*, which comprises representatives with functionally dioecious flowers arranged in pendulous or erect inflorescences. *Ribes* subg. *Parrilla* is most diverse in the Neotropics and includes approximately 45 species that occur in the Andean highlands at 2750 to 4267 m. While *R. austroecuadorense* is endemic to the south of Ecuador, *R. erectum* also occurs in Colombia.

Ribes erectum A. Freire-Fierro, sp. nov. TYPE: Ecuador. Azuay: Carretero Cuenca–Sayausí–Molleturo, 9 km from entrance to Parque Recreacional Cajas, 79°09′W, 02°49′S, 3370 m (pistillate), *Freire-Fierro & Romoleroux 2416* (holotype, QCA; isotype, AAU). Figure 1.

Ribes lehmannii Janczewski similis sed inflorescentiis erectis, floribus cupulatis et hypanthio minus quam 2 mm longo differt.

Shrub, (0.2–)1–4(–6) m tall, erect or seldom scandent. Branches slightly hairy with sessile glands. Lamina elliptic in outline, 1.4–4.0(–5.5) cm long, 0.9–1.5(–2.5) cm wide, the base decurrent to cuneate, the apex acute, unlobed to weakly 3-lobed, the margin serrate, subcoriaceous, with sessile glands beneath and above; petioles 0.5–0.7(–1.3) cm long, glabrescent, with a winged base. Inflorescence 4.5–8.0(–10) cm long, erect, 16–30-flowered; rachis densely pubescent; bracts narrowly ovate, 2–4(–5) × 0.5–1 mm, base truncate, apex acute, ciliate, dorsal face densely pubescent with sessile glands; pedicel 1.0–1.5 mm long, densely pubescent with sessile glands; bracteoles obovate, 0.8–1.4 mm long, 0.5 mm wide, apex acute with a stipitate gland. Flowers cup-shaped, 2.0–4.5 mm long, 2–4(–5) mm wide; hypanthium 0.8–2 mm long, calyx lobes 1–2 mm long, 0.8–1.5 mm wide, slightly reflexed, densely pubescent with sessile glands, externally green-brown, internally pale green; petals 0.5–0.8 mm long, 0.5–1 mm wide, apex obtuse to acute, green-yellowish; ovary nearly glabrous with sessile glands; staminate flower with filaments 0.5–1 mm long, anthers 0.5 mm long, 0.5–0.8 mm wide, pistil rudimentary; pistillate flower with stamens rudimentary, ovary bicarpellate, styles 1.0–1.8 mm long, bilobed ⅓ to ⅕ of their length. Fruit spheroidal, about 8 mm long, 7 mm wide, erect, with sessile glands, striate, green to yellow.

→

Figure 1. *Ribes erectum* A. Freire-Fierro. —A. Flowering branch. Note short persistent peduncles where older flowers have fallen away. —B1–B7. Leaves. —C. Abaxial side of the leaf. —D. Pistillate flower. —E. Longitudinal section of a pistillate flower. —F. Staminate flower (arrows showing stipitate glands in bracteoles). —G. Longitudinal section of a

staminate flower. —H. Young fruit. (A, drawn from *Asplund 17837*; B4, B6, C, D, E, and H, from *Freire-Fierro & Romoleroux 2416*; B1, F, and G, from *Luteyn & Lebrón-Luteyn 5771*; B2, from *Harling 1247*; B3, from *Jaramillo 7319*; B5, from *Løjtnant & Molau 14277*; B7, from *Harling et al. 8712*.)

Variation and affinities. *Ribes erectum* is a distinctive species that has not been described before even though it is quite common. The presence of sessile to subsessile glands in the adaxial and abaxial surfaces of the leaves, the erect inflorescences, the cup-shaped flowers, and the erect and yellowish fruits are the distinguishing features of this species. According to Jancezwski's (1907) taxonomic treatment of the genus, all the Ecuadorian species of *Ribes* have pendulous inflorescences, but the two newly described species have erect inflorescences. Representatives of *R. erectum* have sometimes been misidentified as *R. lehmannii* because of the cuneate leaves with sessile glands; however, they differ from the latter by the cup-shaped flowers, and the green to green-brownish hypanthia less than 2 mm long.

Flowering and fruiting. *Ribes erectum* flowers throughout the year, and fruiting specimens have been collected from February to August, and from November to December.

Distribution and habitat. This species occurs on grass páramo and in wet montane forests at 2750 to 3920 m. It has been collected in the central and southern Ecuadorian Andes, and in southern Colombia.

Paratypes. COLOMBIA. **Nariño:** Volcán Galeras, near Pasto, ca. 2800 m, *Gentry et al. 30489* (MO). ECUADOR. **Pichincha:** Sebritana, Hda. Pedregal and Yanaurcu, 3400–3500 m, *Acosta Solís 8307* (F), *Jameson s.n.* (K), *Jameson & Hooker s.n.* (1838) (K). **Cotopaxi/Napo:** Salcedo–Napo road, 22–47 km to the N, 3400–3920 m, *Freire-Fierro & Viteri 2447a, 2447b* (AAU, QCA), *Jørgensen et al. 56322* (AAU, QCA, QCNE); km 52, *Løjtnant & Molau 13782* (AAU, GB, QCA). **Tungurahua:** Llanganati, Chihuila Sacha or Ainchilibí, 3750 m, *Barclay & Juajibioy 8962* (MO); Aucacocha–Tambo, 2750–2800 m, *Jaramillo 6297* (QCA); N of Choza Aucacocha, 3500 m, *Øllgaard et al. 38608* (AAU). **Chimborazo:** Alao–Llactapamba road, Páramo de Culebrillas, *Cerón et al. 11775* (MO, QCNE); Alao–Huamboya road, km 8, 3700 m, *Jørgensen 91801* (AAU, QCA, QCNE); valley of Río Alao, 3450 m, *Huttel 951* (QCA); to 10 km NE of Alao, Cuspipaccha, 3500 m, *Øllgaard et al. 38133* (AAU, NY, QCA); Guayllabamba–Alao road, 2900–3100 m, *Romoleroux 368* (F, NY, QCA); Atilio, slope of Laguna Negra, 3600 m, *Brandbyge 60978* (AAU); Riobamba–Alao–Huamboya road, Quebrada Supaycahuan, 3570–3620 m, *Zak & Jaramillo 3307* (MO). **Cañar:** Azogues–Moloboc Grande road, 3200–3450 m, *Jaramillo 9856* (AAU, QCA), *Romoleroux et al. 399* (F, NY, QCA); Azogues–Pindilig road, km 21–22, 3250–3350 m, *Løjtnant & Molau 14277* (AAU, GB); 30 km NE of Azogues, Río Dudas, *Prieto P-150* (NY); Taday, 2–3 km W, 3100–3200 m, *Harling 27243* (GB); Virgin Corral, 4.5 km SW, 3150 m, *Holm-Nielsen et al. 29214* (AAU). **Azuay:** Chiquintad–Planta Hidroeléctrica Chanlud–Tuni road, km 27, at Presa Chanlud, 3400–3500 m, *Øllgaard et al. 98652* (AAU, QCA, QCNE); Chiquintad–Represa de Empresea Eléctrica–Labrado road, *Jaramillo et al. 8903* (AAU, F, NY, QCA); Cuenca–Molleturo road, Parque Recreacional Cajas, 3350–3890 m, *Böhlin et al. 1393* (GB, QCA), *Freire-Fierro & Romoleroux 2416* (AAU, QCA); Laguna Surucuchu, Sayausí, W side, 3200–3300 m, *Harling 25474* (GB); 10 km W, 3300 m, *Harling et al. 20222* (GB); Soldados, below Quinoas, 3400 m, *Harling et al. 8747* (GB), *Huttel 986* (QCA); Guabidula, *Jaramillo & Winnerskjold 5424* (QCA); Llavinco, *León et al. 2573* (QCA); 25 km of Cuenca, 3500 m, *Madsen et al. 36593* (AAU); 1 km before the Control to Loja, deviation to Yanasacha, *Jaramillo & Boeke 300, 342* (AAU, QCA); Río Machángara, NW of Cuenca, 3300–3400 m, *Sparre 18569* (S); Sevilla de Oro, 4–6 km N, 2953–3280 m, *Camp E-4715* (A, F, K, S, US, W); 6–8 km NNE, Páramo del Castillo, 3280–3390 m, *Camp E-5127* (AAU, NY, S, US); 3700 m, *Harling 1247* (S); 10 km NNE, 3200–3350 m, *Øllgaard & Balslev 9425* (AAU, F, MO, NY, S); Gualaceo–San Juan Bosco road, 3 km W of pass, 3250–3350 m, *Laegaard 53949* (AAU, QCA); Cuenca–Machala road, km 22, turnoff towards Patacocha, km 7, 3000 m, *Jørgensen et al. 91910* (AAU, QCA, QCNE), *Romoleroux et al. 444* (NY, QCA); Gañadel, 3450 m, *Asplund 17837* (S); Cumbe, 3100 m, *Harling et al. 8712, 8714* (GB); 10–20 km S, páramo of Tinajillas, 3000–3400 m, *Camp E-378* (NY); 3700 m, *Camp E-493* (NY); 3000–3300 m, *Harling et al. 20115* (GB); Cuenca–General Plaza (Limón) road, 3100–3500 m, *van der Werff & Gudiño 11434* (MO, QCNE); 2800–3500 m, *van der Werff & Gudiño 11079* (MO); páramo de Patococha, 3300–3400 m, *Barclay & Juajibioy 8622* (MO, US); 3200–3300 m, *Dorr & Barnett 5995* (NY, QCA, QCNE), *Harling & Andersson 22719* (GB, QCA); summit of Cordillera Zapote Naida, 3450 m, *Harling 25974* (GB), *Jørgensen 92674* (AAU, MO, QCA, QCNE), *Luteyn & Lebrón-Luteyn 5771* (AAU, GB, NY, QCA), *Luteyn 13410* (NY, QCA, QCNE); 21 km E of Gualaceo, 3200 m, páramo de Culebrillas, *Luteyn et al. 14116* (MO, NY); *Romoleroux 432* (NY p.p., QCA), *437* (NY, QCA); between Huagrarancha and Mt. Galápagos, 3140–3505 m, *Steyermark 53465* (MO, NY). **Loja:** Cerro Chinchilla, Celén, 3500–3780 m, *Jaramillo 7319* (AAU, GB, MO, QCA); Loja–Saraguro road, 5 km N of San Lucas, 2800 m, *Böhlin & Böhlin 1028* (GB); Loma del Oro, turnoff towards Fierro–Urco, km 12, 3400–3650 m, *Jørgensen & Madsen 65805, 65821* (AAU, QCA), *Madsen & Ellemann 85636* (AAU, QCA, QCNE); 10 km of Pichig, 3000–3500 m, *Madsen 86739* (AAU), *Øllgaard et al. 90990* (AAU, F, MO, QCA, QCNE), *Romoleroux 761* (AAU, NY, QCA). **Napo:** Río Chalupas, 3700 m, *Laegaard 101779* (AAU, QCA); Río Langoa, 3400 m, *Jaramillo 9610* (AAU, QCA).

Ribes austroecuadorense A. Freire-Fierro, sp. nov. TYPE: Ecuador. Loja: Parque Nacional Podocarpus, E of Nudo de Cajanuma, trail from Centro de Información toward Lagunas del Compadre, ca. 79°10′W, 04°05′S, 3100–3200 m (pistillate), *Øllgaard 90339* (holotype, QCA; isotypes, AAU, QCNE). Figure 2.

Ribes andicola Janczewski similis sed inflorescentiis erectis, foliis 3-fissis et bracteis quam 5 mm longioribus differt.

Low prostrate shrub. Branches hairy. Lamina ovate in outline, 1.7–5 cm long, 1.0–3 cm wide, base cuneate, apex acute, 3-lobed–3-cleft, margin

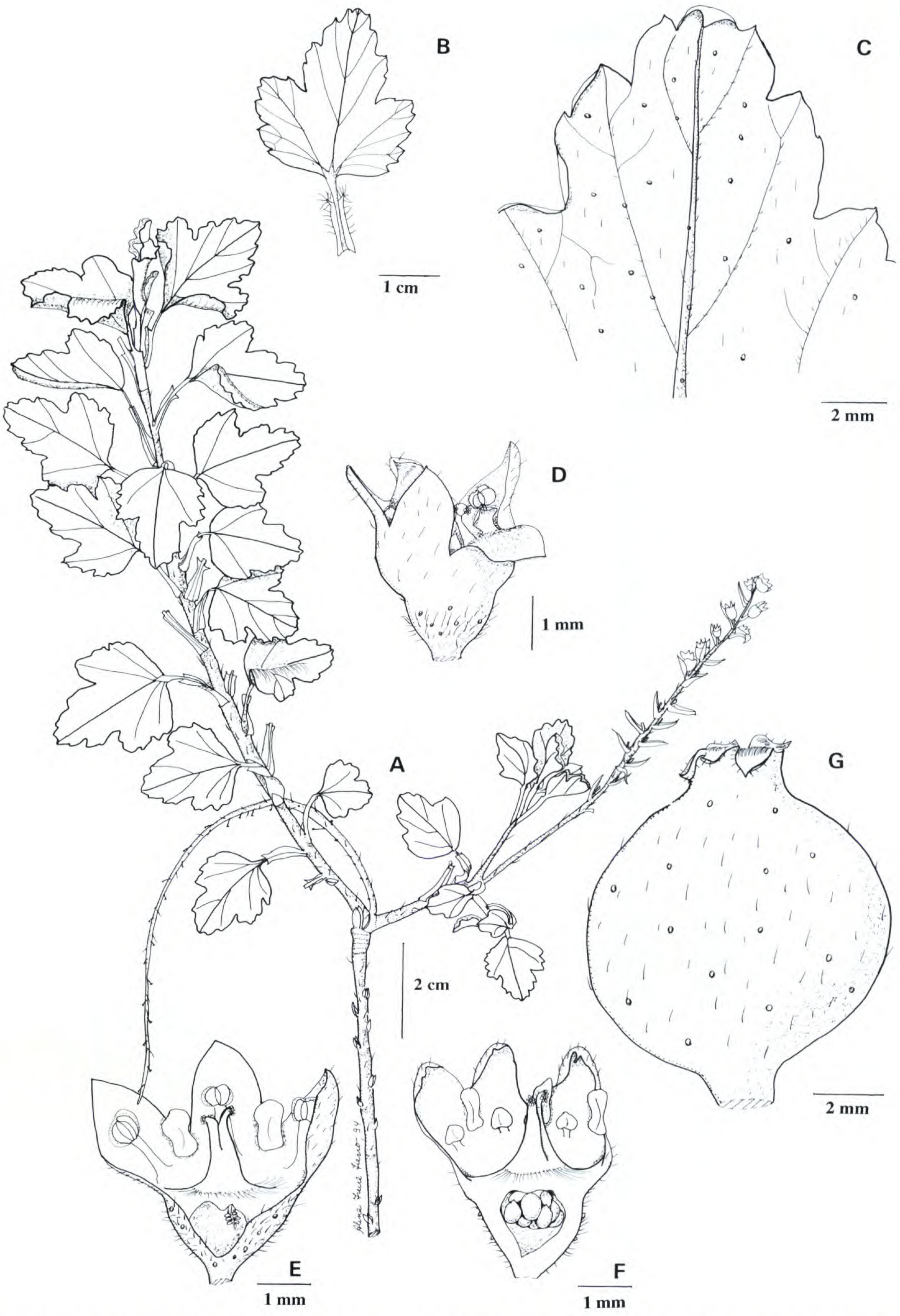


Figure 2. *Ribes austroecuadorense* A. Freire-Fierro. —A. Flowering branch. —B. Leaf. —C. Abaxial side of the leaf. —D. Staminate flower. —E. Longitudinal section of a staminate flower. —F. Longitudinal section of a pistillate flower. —G. Fruit. (A–C, F, G, drawn from *Øllgaard 90339*; D, E, from *Madsen & Pedersen 86464*.)

serrate, leathery, slightly pilose with sessile glands beneath, pubescent above; petioles 0.8–2.5 cm long, hairy, with a winged and fringed base. Inflorescence 5–11 cm long, erect, 26–28-flowered; rachis hairy; bracts narrowly elliptic, 5–8 mm long, 1.5 mm wide, base truncate, apex acute, ciliate with subsessile glands, dorsal face hairy with sessile glands; pedicel 1.5 mm long, hairy; bracteoles obovate, 1.0–1.5 mm long, 0.5 mm wide, apex obtuse with a terminal stipitate gland. Flower cup-shaped, 4–5 mm long, 3.5–4.5 mm wide; hypanthium 1.8–3 mm long, calyx lobes 2 mm long, 1.2–1.5 mm wide, reflexed, hairy, externally pale green, pinkish tinged; petals 0.8–1 mm long, 0.5 mm wide, apex obtuse; ovary densely pubescent with sessile glands; staminate flower with filaments 1.0–1.2 mm long, anthers 0.5 mm long, 0.5–0.7 mm wide, pistil rudimentary; pistillate flower with stamens rudimentary, ovary bicarpellate, styles 1.5–1.8 mm long, bilobed ⅓ of their length. Fruit spheroidal, about 7.8 mm long, 8.5 mm wide, erect, hairy with sessile glands, striate.

Ribes austroecuadorense is a rare species known from only two localities. Although this species resembles *R. andicola*, it differs by the 3-cleft leaves, the erect inflorescences, and the bracts, which are longer than 5 mm. In addition, *R. austroecuadorense* has pinkish petioles and bicolored leaves, characters absent in *R. andicola*. Besides *R. austroecuadorense*, *R. leptostachyum* is the only other species of *Ribes* in Ecuador with up to 3-cleft leaves.

Flowering and fruiting. February and November.

Distribution and habitat. *Ribes austroecuadorense* occurs in scrub páramo and elfin forest, at 3000 to 3480 m elevation. It is endemic to southern Ecuador.

Paratypes. ECUADOR. **Azuay:** Gualaceo–Limón road, ca. 23 km W of Gualaceo, Páramo de Culebrillas, 3477 m, *Luteyn et al. 14127* (QCA). **Loja:** Parque Nacional Podocarpus, Lagunas de Compadre, ca. 6 hours walking from Centro de Información, 3000–3400 m, *Madsen & Pedersen 86464* (AAU, QCA).

Acknowledgments. I thank Benjamin Øllgaard and Henrik Balslev from the University of Aarhus (Denmark) for economic and logistic support, Laura Arcos Terán and Alberto Padilla from the Pontificia Universidad Católica del Ecuador for allowing me to use the university's facilities, Henk van der Werff for help with the Latin diagnoses, and Susanne Renner for comments on the manuscript. I also thank AAU, F, GB, K, MO, NY, QCA, QCNE, S, US, W, and other herbaria that allowed me to study *Ribes* material.

Literature Cited

Janczewski, E. 1907. Monographie des groseilliers, *Ribes* L. Mém. Soc. Phys. Genève 35: 199–517.

Valsecchi, F. 1977. Biologia, posizione sistematica e ecologia di *Ribes sardoum* Martelli e *Ribes multiflorum* Kit. ssp. *sandalioticum* Arrigoni. Webbia 31: 279–294.

Una Nueva Especie de *Pachycereus* (Cactaceae) del Occidente de México

Susana Gama-López and Salvador Arias

Jardín Botánico, Instituto de Biología, UNAM, Apartado Postal 70-614, 04510 México, D.F., México

RESUMEN. Se describe e ilustra a *Pachycereus tepamo* (Cactaceae, Cactoideae, Pachycereeae), una especie nueva de la cuenca baja del Río Balsas, en el estado de Michoacán, México. Se presentan datos sobre su hábitat, distribución geográfica y usos locales. También se compara esta especie a partir de caracteres morfológicos con *P. grandis*, *P. pecten-aboriginum* y *P. weberi*, consideradas las especies más relacionadas.

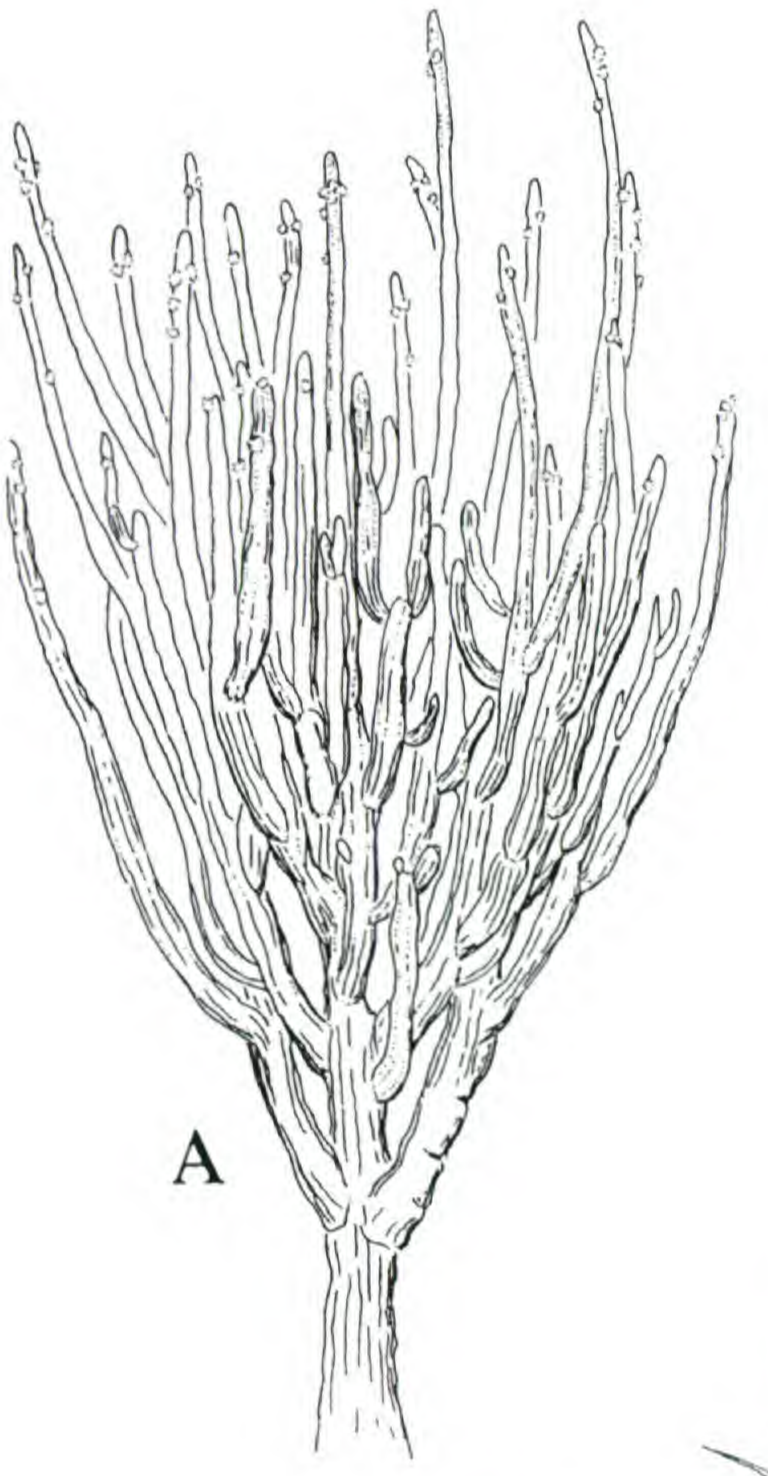
ABSTRACT. *Pachycereus tepamo* (Cactaceae, Cactoideae, Pachycereeae), a new species from the lower basin of the Balsas River, in the state of Michoacán, Mexico, is described and illustrated. Information concerning its habitat, geographic distribution, and uses is also presented. In addition, morphological characters are used to compare this species with *P. grandis*, *P. pecten-aboriginum*, and *P. weberi*, its closest allied species.

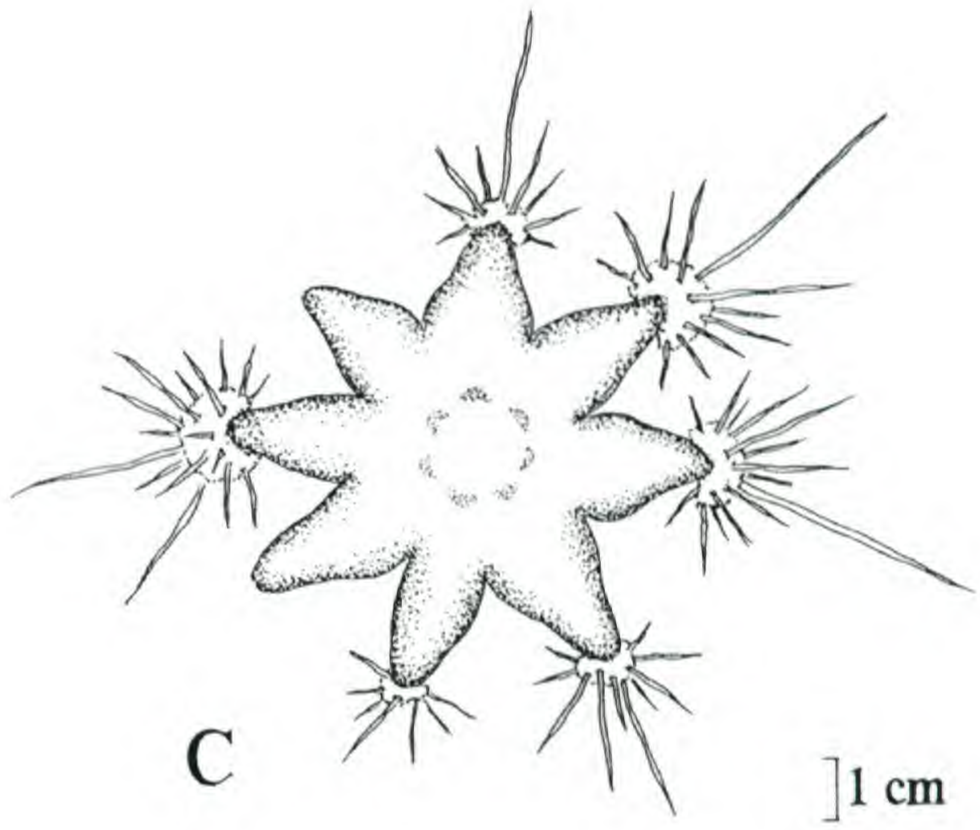
Después de realizar un estudio comparativo a nivel morfológico, micromorfológico de la cubierta seminal, cariológico y del desarrollo de las plántulas de *Pachycereus weberi* (J. M. Coulter) Backeberg, se encontraron diferencias en algunas poblaciones que sustentan la existencia de una especie nueva (Gama-López, 1993), la cual es descrita a continuación.

Pachycereus tepamo S. Gama & S. Arias, sp. nov. TIPO: México. Michoacán: Mpio. La Huacana, 1 km al sur de Piedras Verdes, carretera La Huacana–Nuevo Churumuco, 5 July 1992, *L. Ulises Guzmán-Cruz 906, con Susana Gama & Salvador Arias* (holótipo, MEXU; isótipos, ENCB, IBUG, MO). Figuras 1, 2.

Pachycereus grandis, *P. pecten-aboriginum* et *P. weberi* affinis habitu arborescenti, forma et dispositione floris et fructo structurarum sed ramis sterilibus cum spina centrali polyedrica sectione transversali et bracteis tubi receptaculi carnosis areolis axillaribus plerumque nudis differt.

Arborescentes, 7.0–10.0(–12.0) m de alto, candelabriformes. Tallo principal grueso, ca. 1.0 m de alto, sin espinas; ramas ca. 20.0 cm ancho, verticales, con ramificación basal, verde azulosas, diferenciadas en una zona infértil y otra fértil, costillas (7–)8–9(–10), 1.5–2.5(–3.0) cm de alto; aréolas de la zona infértil (1.0–)1.5–2.0(–2.5) cm de largo, 1.0–1.5(–2.0) cm de ancho, elípticas, distancia entre ellas de (1.0–)1.5–4.5(–5.0) cm, con lana pardo-amarillenta al principio, cambiando gradualmente a blanco-grisácea; espinas radiales (6–)7–10(–11), 0.5–2.0(–3.0) cm de largo, aplanadas en sección transversal, rígidas, blanco-grisáceas, la base y el ápice negros; espinas centrales 4(–5), 2.0–4.0(–4.5) cm de largo, de ellas dos están dirigidas hacia abajo y una hacia arriba, aplanadas en sección transversal, la otra perpendicular al tallo, poliédrica en sección transversal, con base pentagonal, todas rígidas, blanco-grisáceas, con base y ápice negros; aréolas de la zona fértil 1.0–2.0(–2.5) cm de largo, 1.0–2.0 mm de ancho, circulares, con lana pardo-amarillenta, espinas 17–45, 1.0–5.0(–6.0) cm de largo, no diferenciadas en centrales y radiales, insertadas en toda la aréola, aciculares, setosas, las más grandes se enrollan en forma de hélice, grises con tonalidades pardas. Flores 6.0–8.0 cm de largo, infundibuliformes, nocturnas, subapicales; pericarpelo 1.5–2.5 cm de largo, 0.8–1.5 cm de ancho, ovado a ovalado, amarillo-pardo, las bractéolas 2.0–3.0 mm de largo, deltoides, ligeramente apiculadas, aréolas axilares con lana abundante que cubre al pericarpelo e impide distinguir los podarios, las cerdas ca. 5, aciculares, amarillentas con el ápice pardo oscuro; tubo receptacular 3.0–4.5 cm de largo, carnoso, las brácteas 0.5–1.0 cm de largo, triangulares a oblongas, el ápice apiculado, decurrentes en la base, carnosas, el margen entero, púrpura-glauco, las aréolas axilares desnudas, ocasionalmente con pelos escasos, cortos, amarillos y ocultos por las brácteas; tépalos externos 1.0–2.0 cm de largo, 1.0–1.5 cm de ancho, lanceolados, el margen eroso, el ápice hendido o retuso, apiculado, tépalos internos 1.0–2.0 cm de largo, 1.0–1.5 cm de ancho, lanceolados, el margen eroso, el ápice hendido, apiculado; cámara nectarial 2.0–2.5 cm de largo; estambres 0.5–1.0 cm de





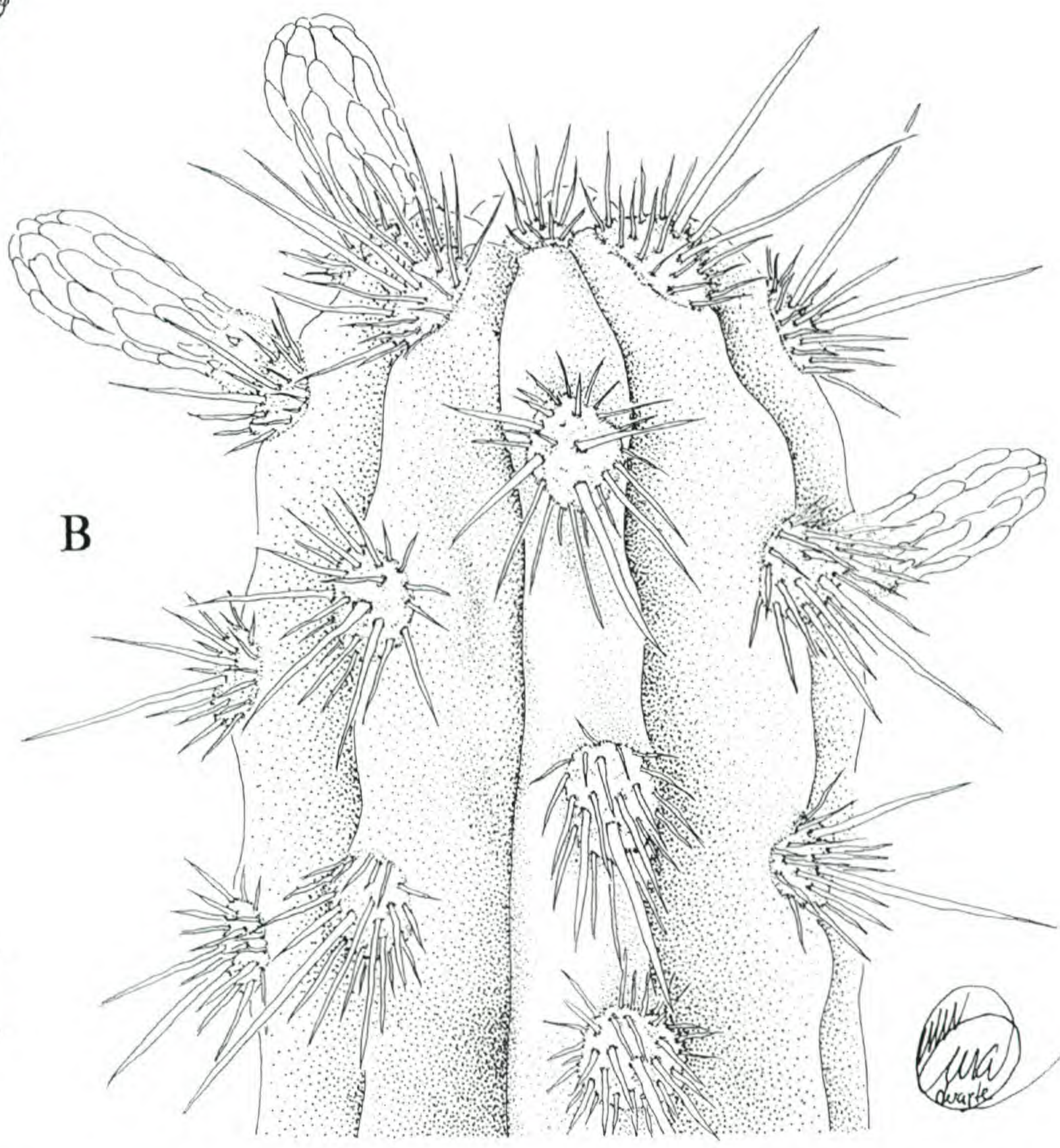


Figure 1. *Pachycereus tepamo* S. Gama & S. Arias (*Guzmán-Cruz 906*). —A. Hábito de la planta. —B. Zona fértil de una rama. —C. Sección transversal de la zona fértil de una rama.

largo, filamentos 3.0–8.0 mm de largo, insertados a lo largo del tubo receptacular; polen tricolpado; estilo 3.5–4.0 cm de largo, blanco-amarillento, lóbulos del estigma 9, ca. 1.0 cm de largo, con papilas, amarillo-purpúreos. Fruto 3.0–6.0 cm de largo, 3.0–5.5(–6.5) cm de ancho, subgloboso, rojo-purpúreo, carnoso, dehiscente, pericarpo cubierto de aréolas 0.5–0.8(–1.0) cm de largo, 0.4–0.8(–1.0)

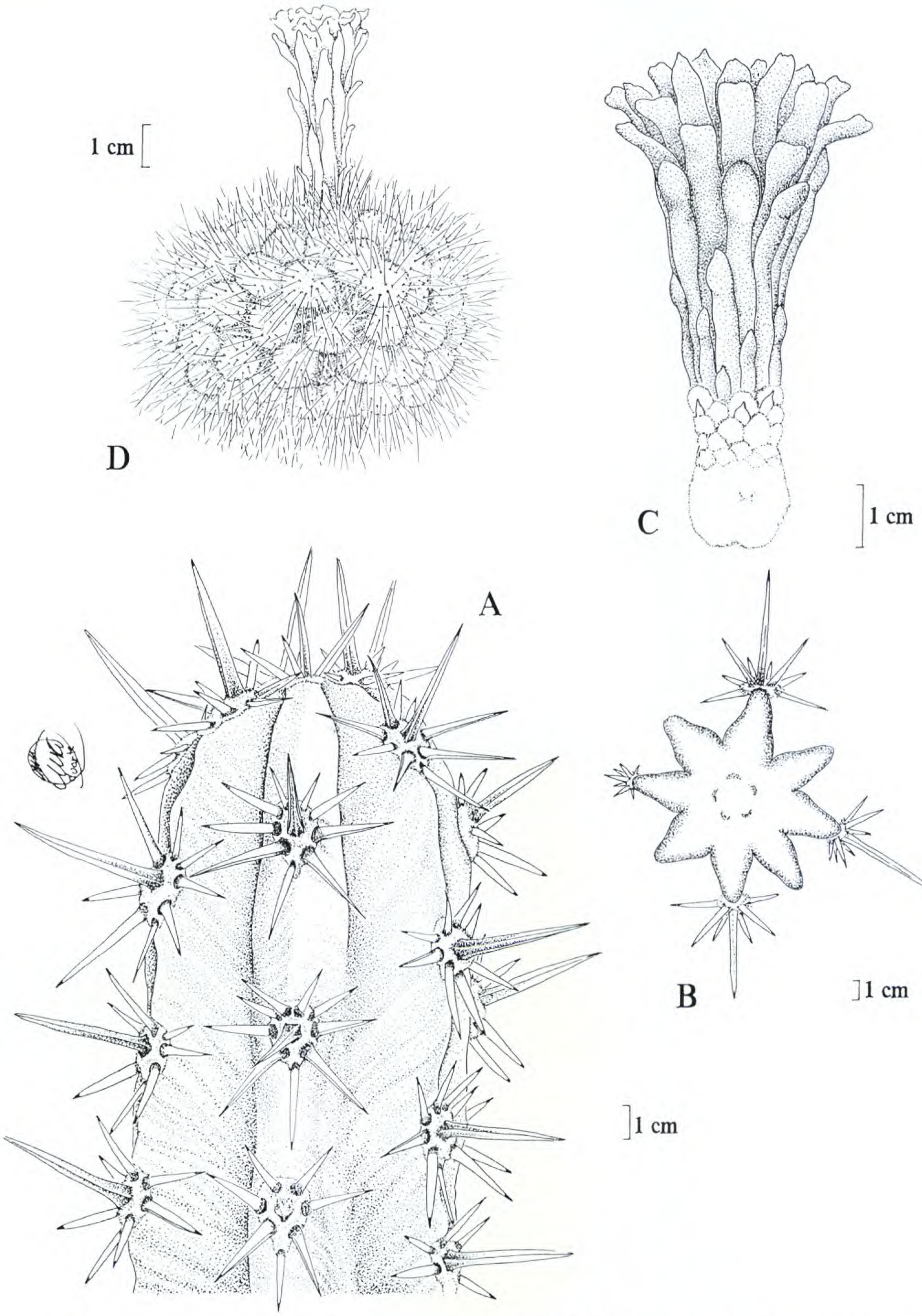


Figure 2. *Pachycereus tepamo* (*Guzmán-Cruz 906*). —A. Zona infértil de una rama. —B. Sección transversal de la zona infértil de una rama. —C. Flor en vista externa. —D. Fruto en vista externa.

cm de ancho, lana pardo-amarilla, las cerdas (0.5–) 1.0–2.5(–3.0) cm de largo, pardo-amarillas; pulpa carnosa, rojo-púrpura, dehiscente; semillas 3.6–4.8 mm de largo, 2.8–3.5 mm de ancho, piriformes, negro brillantes de relieve plano, paredes anticlinales rectas, en ocasiones sinuosas, intersticios celulares no punteados. Número cromosómico $2n = 22$, $n = 11$.

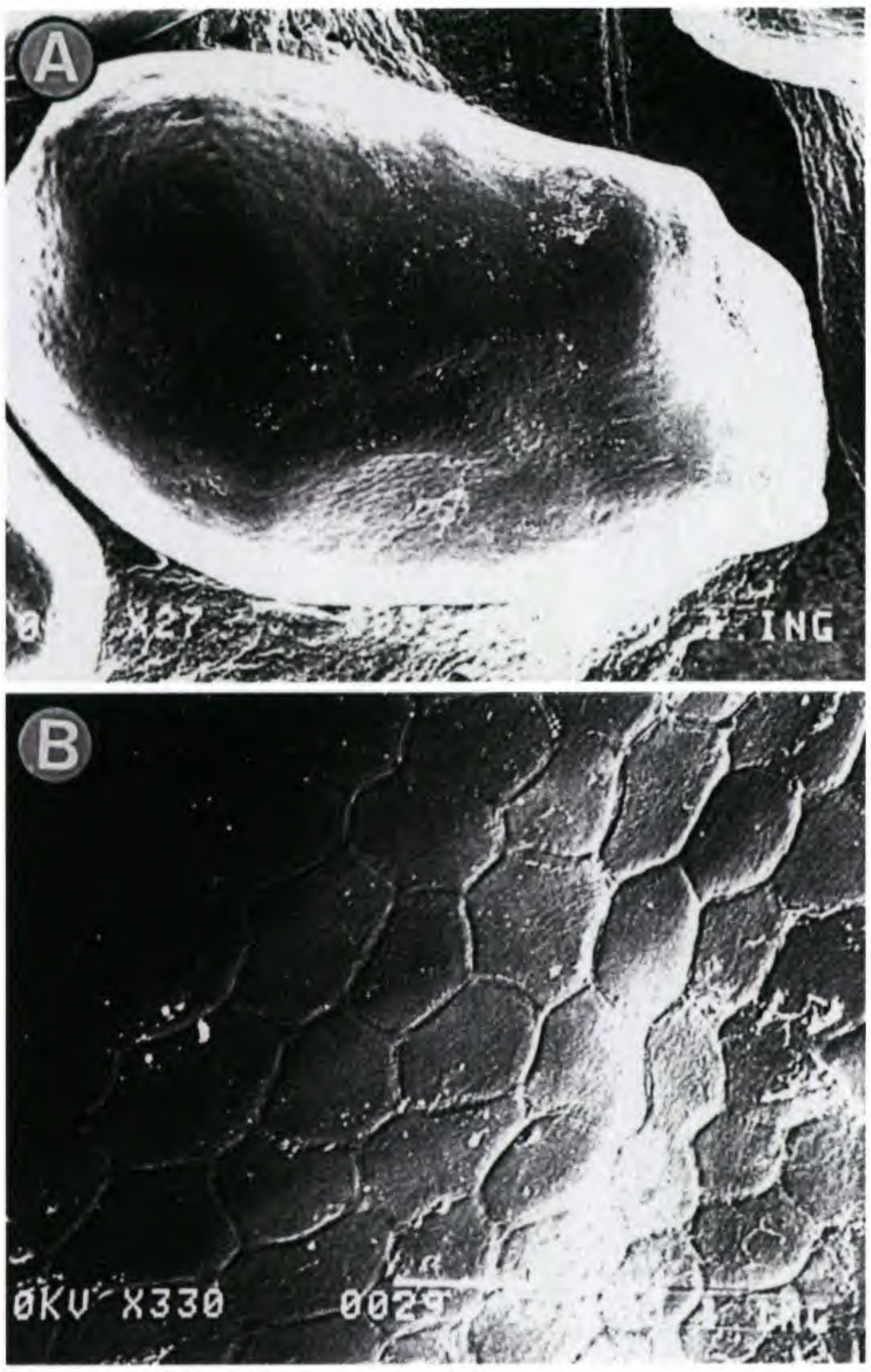


Figure 3. Fotomicrografía en el MEB de la semilla de *P. tepamo* (*Gama & Flores 74*). —A. Semilla completa (24×). —B. Testa de la región central de la semilla (330×).

Discusión. De acuerdo a la información proporcionada por Gibson y Horak (1978), la nueva especie aquí descrita se ubica en el género *Pachycereus* por el hábito arborescente, porque el parénquima de las ramas adquiere tonos oscuros al contacto con el aire (condición que indica la presencia de alcaloides) y por las semillas piriformes, negro brillantes (Fig. 3). Entre las especies del género, *Pachycereus tepamo* es semejante a *P. grandis* Rose y *P. pecten-aboriginum* (Engelmann) Britton & Rose por la presencia de ramas diferenciadas en una zona fértil (Fig. 1B), constituida por espinas que se modifican en número, tamaño, forma, consistencia y color con respecto a las espinas de la zona infértil (Fig. 2A). Sin embargo, *P. tepamo* es diferente de ellas por la presencia, en la zona infértil, de una espina central de forma poliédrica en sección transversal. A este respecto, es necesario señalar que el contorno de las espinas centrales es constante entre las especies aquí señaladas. Por otro lado, el tubo receptacular de las flores de *P. tepamo* es carnoso y con aréolas axilares desnudas, aunque en forma ocasional presenta pelos escasos que permanecen ocultos por las brácteas (Tabla 1). *Pachycereus tepamo* es también semejante a *P. weberi* por el hábito arborescente y por la forma de la flor. Por tal motivo Bravo-Hollis (1978) y Blanco et al. (1980) consideraron que se trataba de una posible variedad o forma geográfica de *P. weberi*; sin embargo, *P. tepamo* es diferente porque las ramas tienen una zona fértil diferenciada de la infértil (Tabla 1).

Respecto a la fenología, existen diferencias marcadas en los períodos de floración de las especies señaladas. En *Pachycereus tepamo* la floración es

Tabla 1. Comparación morfológica entre *P. grandis*, *P. pecten-aboriginum*, *P. tepamo* y *P. weberi*.

Caracteres	*P. tepamo*	*P. grandis*	*P. pecten-aboriginum*	*P. weberi*
Ramas: con zonas fértil e infértil	si	si	si	no
Ramas: surco longitudinal entre las aréolas de las ramas	ausente	ausente	ausente o presente	presente
Aréolas de la zona infértil: número de espinas centrales	4(–5)	1(–3)	1(–3)	1(–3)
Aréolas de la zona infértil: forma de la espina central en sección transversal	poliédrica	aplanada-subulada	aplanada-cónica	aplanada
Flor: pericarpelo cubierto de lana	si	si	si	no
Flor: consistencia de las brácteas del tubo receptacular	carnosas	coriáceas	coriáceas	coriáceas
Flor: aréolas axilares del tubo receptacular con espinas, cerdas, pelos y/o lana.	no	si	si	si
Semillas: largo (mm)	3.6–4.8	5.0–6.0	3.5–5.0	2.5–3.5

de julio a agosto, en *P. grandis* es de enero a marzo, en *P. pecten-aboriginum* de enero a mayo y en *P. weberi* de enero a abril.

Pachycereus tepamo se conoce únicamente de la cuenca baja del Río Balsas, en las inmediaciones de la Presa del Infiernillo, Michoacán. Aunque no se conocen registros en el estado de Guerrero, posiblemente se encuentre en sus límites. *Pachycereus tepamo* es un componente del bosque tropical caducifolio y crece a un intervalo altitudinal de 150 a 1100 m. En esta región las ramas son utilizadas como forraje. El epíteto específico se refiere al nombre común que tiene en esa zona.

Paratipos. MEXICO. **Michoacán:** Mpio. La Huacana, carretera Zicuiran–Nuevo Churumuco, 26 Aug. 1989, *S. Gama & S. Arias 1* (MEXU); rancho El Tepetate, 7 km al sur de la desviación a Nuevo Churumuco, 4 July 1991, *S. Gama & G. Flores 74* (MEXU); Mpio. Huetamo de Núñez, 10 km al este de San Jerónimo, sobre la cuenca del Río Balsas, 3 July 1992, *S. Gama et al. 107* (MEXU); Mpio. Nueva Italia, 15 km de Las Cañas, 92 km de Nueva Italia, Presa del Infiernillo, 25 Mar. 1979, *O. Castillo & J. L. Contreras C-57* (FCME); Mpio. Nuevo Churumuco, cerca de La Presa del Infiernillo, 7 July 1970, *H. Sánchez-Mejorada 70-0702* (MEXU); carretera Morelia–Arteaga km 200.5 de Morelia, 23 Mar. 1977, *H. Sánchez-Mejorada 2701* (MEXU); 16 km carretera Churumuco–Zicuirán, 17 Oct. 1987, *Sánchez-Mejorada et al. 4212* (MEXU).

Agradecimientos. A Patricia Dávila y José L. Villaseñor por la revisión de este manuscrito. A José L. Villaseñor por la traducción en latín. A los herbarios FCME y MEXU por los préstamos recibidos durante este estudio.

Literatura Citada

Blanco C., M., O. Castillo & C. M. Toledo. 1980. Estudio preliminar de las Cactáceas de la Cuenca Baja del Río Balsas. II. Cact. Suc. Mex. 25: 7–20.

Bravo-Hollis, H. 1978. Las Cactáceas de México, 2a. ed., Vol. 1. Universidad Nacional Autónoma de México, Mexico.

Gama-López, S. 1993. Análisis morfológico y cariológico de *Pachycereus weberi* (J. Coulter) Backeb. y *Pachycereus* aff. *weberi* (J. Coulter) Backeb. (Cactaceae). Facultad de Ciencias. Universidad Nacional Autónoma de México. Tesis de Licenciatura, Mexico.

Gibson, A. C. & K. E. Horak. 1978. Systematic anatomy and phylogeny of Mexican columnar cacti. Ann. Missouri Bot. Gard. 65: 999–1057.

New Synonymy and Useful Taxonomic Characters in *Smilax* (Smilacaceae) from the Venezuelan Guayana

John F. Gaskin
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Paul E. Berry
Botany Department, University of Wisconsin, 132 Birge, 430 Lincoln Drive, Madison, Wisconsin 53706, U.S.A.

ABSTRACT. In conjunction with a treatment of *Smilax* (Smilacaceae) for the *Flora of the Venezuelan Guayana,* a number of taxonomic changes are proposed for previously described taxa from southern Venezuela. A discussion of morphological characters used in the revision and a key to the species in the Venezuelan Guayana are also presented.

Smilax is a genus of approximately 300 species of dioecious vines inhabiting tropical and temperate areas of both hemispheres, with most species concentrated in tropical Asia and the Neotropics. The genus has a well deserved reputation for being taxonomically difficult. Problems arise from the paucity of fertile collections of both sexes or even a single sex from particular localities (Huft, 1994), the use of characters that are not reliable for species delimitation (Howard, 1979), and conflicting treatment of species across flora boundaries (Sipman, 1979). For future collections of *Smilax,* collectors should strive to obtain samples from both sexes and, even more importantly, include a section or a description of the lower portion of the stem (where larger spines may be found) as well as an upper, fertile portion of the plant.

We recently completed a treatment of the Smilacaceae for the *Flora of the Venezuelan Guayana,* which includes the states of Amazonas, Bolívar, and Delta Amacuro in southeastern Venezuela. At the onset of our project, there were 37 different species names in *Smilax* that had been used to identify herbarium specimens from the flora area. Currently, we recognize only 9 species. We dealt with synonymy of names whose types are from the flora area, but we did not attempt this with species described from other countries. The next logical step in the taxonomic study of South American *Smilax* would be a comprehensive treatment which would include examination of type material and the identification of the many synonyms that undoubtedly exist across national and floristic boundaries.

The following discussion addresses our choice of characters, which should prove useful for future work in other areas. Due to the paucity of comparable fertile collections, we focused on vegetative characters more than reproductive ones. Among the type specimens examined for the nine species currently recognized in the Venezuelan Guayana, only three have flowers, and one has fruit. Also missing from these type specimens (and from most other collections in the flora area as well) is a sample of the lower stem and lower leaves of the plant, which are frequently quite different from the younger, higher stems (Killip & Morton, 1936).

Stem. The presence of stem spines can be a useful character, but young growth is often unarmed, while the base of the stem can be heavily armed. In *Smilax poeppigii* Kunth, spines may be absent on most of the stem, while the base, which may be 20 m away, has dense spines (*Berry et al. 6239,* MO). A character that is more important outside the flora area is the shape of the spines, which can range from terete and needle-like to flattened and triangular. The texture of the stem has been used in many treatments, and Steyermark and Maguire (1972) used the verruculose-tuberculate texture of the stem in *S. jauaensis* Steyermark & Maguire as virtually the sole character to differentiate it from *S. staminea* Grisebach. Stem texture has been shown to be a variable character, and verruculose-tuberculate stems also appear in occasional specimens of *S. staminea.* Another species, *S. lappacea* Humboldt & Bonpland ex Willdenow, which Steyermark and Maguire (1972) noted as having smooth stems, has some specimens with tuberculate stems, although the bumps are typically not darkened and thus not readily visible (*Huber 581,* VEN). Only in the case of *S. schomburgkiana* Kunth did we use stem texture as a diagnostic character. The stem of this species is consistently

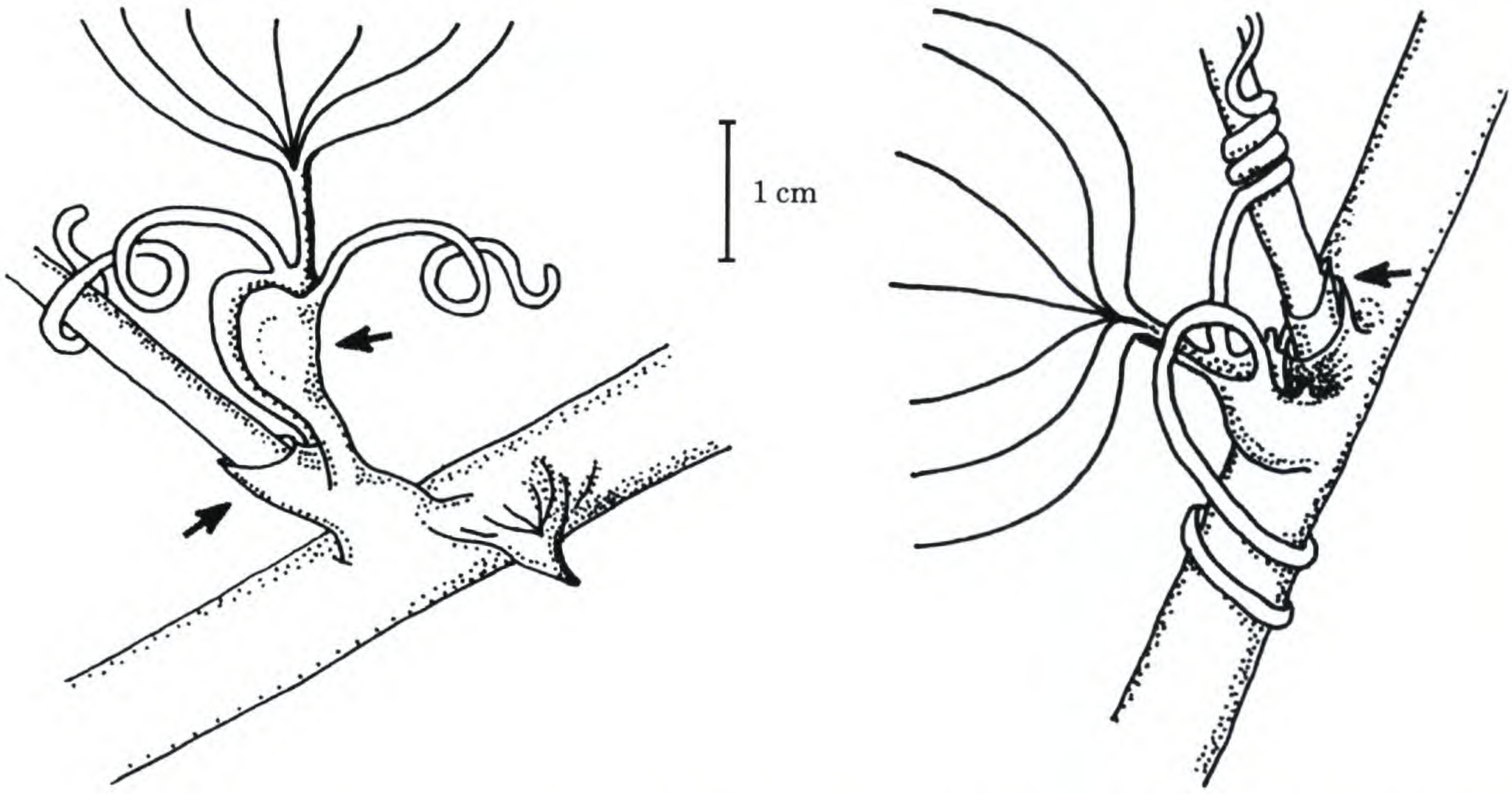


Figure 1, 2. —1 (left). *Smilax siphilitica*, showing the sheath wing on the lower part of the petiole (upper arrow) and the single adaxial scale at the lateral shoot base (lower arrow). Drawn from *Steyermark 58057*, VEN. —2 (right). *Smilax schomburgkiana*, showing two overlapping adaxial scales (arrow) at the lateral shoot base. Drawn from *Morillo & Liesner 8953*, VEN.

roughened (to the point of feeling like coarse sandpaper) on all ages of stem growth.

Stem cross-sectional shape has also been used as a character in distinguishing *Smilax* species (Andreata, 1980, 1995). In the Venezuelan Guayana, *Smilax* stems are mostly round when young, but species from adjoining countries may have quadrangular stems, as *S. longifolia* Richard, or hexagonal, as *S. spruceana* A. DC.

Stem pubescence is a character employed in many regional floras (Huft, 1994; Morton, 1945, 1962; Wallace, 1983). In the Venezuelan Guayana, the only obviously pubescent species is *S. triplinervia* Humboldt & Bonpland ex Willdenow, which is only known from the type specimen.

Lateral shoot bases. The lateral shoots of all *Smilax* species in the Venezuelan Guayana have either a single adaxial (sometimes bifid) scale at the base, or else two closely spaced overlapping scales. The scale closer to the base is a prophyll; when it is followed by a reduced internode, it overlaps a second scale, which is actually a reduced leaf or cataphyll (Sipman, 1979; Guaglianone & Gattuso, 1991); see Figures 1 and 2. Species are very consistent in having either one or two scales, and this character has been underutilized in most other floristic treatments of *Smilax*. The lateral shoots should not be confused with the petioles, which can also have a scale near their junction with the stem and may sometimes appear quite similar to the shoot bases.

For species with a single scale at the base of the lateral shoot, the length of the basal internode compared to the more distal internodes is another useful character (Sipman, 1979). *Smilax staminea* always has the basal internode longer than the more distal ones, and this character has been employed to redetermine many specimens (see Fig. 3).

Sheath wing. If a section of the sheath, proximal to the tendrils, is elongated 5–15 mm perpendicular to the petiole axis, it is called a sheath wing (Sipman, 1979; Mitchell, 1997); see Figure 1. Sheath wing presence or absence is easily determined, but the wings of older herbarium specimens can be broken off and make them appear wingless. In the Venezuelan Guayana, we encountered a problematic group of specimens that had previously been determined as either *S. siphilitica* Humboldt & Bonpland ex Willdenow, *S. pseudosyphilitica* Kunth, *S. aequatorialis* (Grisebach) A. DC., or *S. febrifuga* Kunth, in which we were unable to find any consistent characters to support the four different taxa. Within this complex, we currently view the presence or absence of sheath wings and their size as variable, so while we did not go so far as to synonymize all of the above names (and only the type of *S. siphilitica* was from the flora area), we determined all specimens from this group as *S. si-*

Figure 3. *Smilax staminea*, showing a lateral shoot with the basal internode longer than the more distal ones (upper arrow). Note also the short pedicels (insert), single adaxial scale at base of the lateral shoot (lower arrow), and 5-veined leaf blades. Drawn from *Steyermark 123975*, MO (inset), and *Steyermark et al. 109801*, NY.

philitica due to their other morphological similarities: two lateral shoot base scales, similar petiole length and width, smooth stem texture, glabrous foliage, and common leaf morphology and similar range of reproductive characters. Recently, in a revision of the Brazilian species of *Smilax*, Andreata (1995) did propose placing *S. pseudosyphilitica* and *S. aequatorialis* in synonymy with *S. siphilitica*.

Petiole articulation and length. The point at which a petiole breaks naturally, and the relative length of the section of petiole remaining on the plant when the leaf abscises, were used as important characters by both de Candolle (1878) and Koyama (1960). However, these characters vary in both *Smilax pittieriana* Steyermark and *S. cumanensis* Humboldt & Bonpland ex Willdenow. It is not always clear on herbarium specimens whether the leaf has abscised naturally from the point of articulation, or whether the petiole has broken artificially upon drying.

In material from the Venezuelan Guayana, mature petioles range in length from 5 to 60 mm. When comparing mature leaves, *Smilax poeppigii* has a consistently lower ratio of blade to petiole length (approximately 3:2) than other *Smilax* species from the flora area (usually around 10:1).

Leaf morphology. Leaf shape is generally a poor character in *Smilax* (Howard, 1979; Andreata, 1995), since a species or even a single plant can show a wide degree of variability in leaf shape depending on the position of the shoot (basal stem vs. distal shoots reaching the canopy), age or degree of maturity of the leaf, fertile vs. sterile branch systems, and locally varying environmental factors such as soil type or shade cover. When used carefully, however, such as comparing only fully expanded leaves on lateral shoots, leaf shape can be characteristic of certain species. For example, *Smilax poeppigii* has broadly ovate leaves with cordate bases, and *S. staminea* has ovate-lanceolate leaves with acuminate tips.

Only two species in the flora area typically have leaf spines. *Smilax lappacea* Humboldt & Bonpland ex Willdenow consistently has spines on the leaf margin and lower side of the primary veins. *Smilax maypurensis* Humboldt & Bonpland ex Willdenow varies from having spines on the leaf margin and lower side of the midvein to totally lacking spines on the leaf blade.

The number of primary leaf veins was used as a diagnostic character by de Candolle (1878) and Huft (1994). We found this character to be consistent in some species (*S. schomburgkiana* and *S. triplinervia*, each with 3 primary veins), while other species have a consistent range of primary veins (large mature leaves of *S. pittieriana* are 5-veined, while smaller mature leaves on the same specimen are 3-veined). Mature leaves of *S. poeppigii* have 5 or 7 primary veins. The primary veins closest to the margin can be conspicuous or else so close to the margin that they are barely distinguishable, so we did not resort to using this as a key character in the flora area.

De Candolle (1878) and Morton (1962) relied upon the character of how the primary veins are attached to the main nerve, with character states of triplinerved (the two closest primary veins attached to the main nerve above the base of the leaf) or trinerved (the two closest primary veins attached to the main nerve at the base of the leaf). On the isotype specimen of *S. triplinervia* (*Humboldt & Bonpland s.n.*, photo of B at NY), we found it difficult to detect more than a subtle triplinerved state. Some specimens of *S. schomburgkiana* (which was described as triplinerved by de Candolle) from the flora area have trinerved leaves (*Steyermark 107478*, NY; *Steyermark 87263*, NY). Leaves that are supposed to be trinerved often appear triplinerved when they have dried and folded together near the apex of the petiole.

Mitchell (1997) described a new species (*Smilax saülensis* J. D. Mitchell) from French Guiana based mainly on having the higher-order venation branched inward toward the primary veins (admedially ramified). We found no species with this character state in the Venezuelan Guayana, but it may be of value in other areas.

Inconspicuous higher-order venation was used as a character in the flora area by Steyermark (1951) to distinguish *S. pittieriana*, which has an upper leaf blade surface that is lustrous and almost perfectly flat, with no evident higher-order veins. Huft (1994) also used this same character state to distinguish *S. luculenta* Killip & C. V. Morton. Although secondary veins can be distinguished on some specimens of *S. pittieriana*, they are much less obvious than in most other species.

Inflorescence. Inflorescence type in *Smilax*, i.e., either a simple umbel or raceme, has been used by de Candolle (1878), Koyama (1960), Steyermark (1966), and Mitchell (1997). This character can be useful, though sometimes misleading. Even in de Candolle's fine work there was a category of species in which he was unable to distinguish a raceme from a branch of simple umbels (de Candolle, 1878: 146). One often finds that the peduncle is subtended by a normal leaf, but that leaf falls off, and the remainder of the petiole looks like a bract.

There are also specimens of some species that are characterized by racemosely arranged umbels in which the peduncles are subtended by both fully developed leaves on one part of the plant, and bracts or small leaflets on other parts (*S. schomburgkiana*: *Steyermark 107478*, NY, and *S. pittieriana: Steyermark 90823*, US).

Receptacle and pedicel length. The shape of the inflorescence receptacle can be either globular or reniform (Sipman, 1979), with reniform receptacles generally associated with flattened peduncles. In the Venezuelan Guayana, we found that the peduncles of all species were somewhat flattened, although the thinner ones appear more terete, so that receptacle morphology appears to be largely a function of the thickness of the peduncle. Sipman (1979) indicated that each receptacle morphology has its own type of bract, the globular receptacles with acute, stiff bracts, and the reniform receptacles with obtuse, soft bracts.

We used the ratio of pedicel length to peduncle length as a fairly consistent character to differentiate *Smilax cumanensis* from *S. lappacea* and *S. maypurensis*. In most species, however, peduncle length is too variable to use as a consistent character, or else pedicels are lacking on many herbarium specimens.

Number of flowers per receptacle. This character is variable in most species from the flora area, though the species we treat as *Smilax poeppigii* often has 30–70 flowers per receptacle, which is unusually high compared to other flora-area species. Koyama (1960) used flower number to separate sections within *Smilax*. This character has been reported to vary with the sex of the plant as well as on different parts of the plant (Howard, 1979), and thus may not be reliable except in extreme contrasts.

Floral characters. According to Howard (1979), perianth color can vary even within a single plant. Notations on specimen sheets from the Venezuelan Guayana show fairly consistent color within some species (*S. lappacea* and *S. pittieriana*, with green flowers), and a range of colors in other species (*S. maypurensis*, *S. siphilitica*, and *S. staminea*, with white to green flowers). When dried, however, flowers of all species eventually turn a similar brownish red.

Perianth length may vary between the two sexes of the same species, with the staminate perianth parts up to 50% longer than those of pistillate plants (Howard, 1979). Although perianth length has been used in many treatments (de Candolle, 1878; Morton, 1945; Huft, 1994; Killip & Morton, 1936), we did not use it as a key character due to its wide variability and the lack of flowers on numerous herbarium specimens. For the same reason, we did not use the presence or number of staminodes as a character, despite its prior use in various *Smilax* treatments (Koyama, 1960; Morton, 1962). Howard (1979) found that the number of staminodes in pistillate flowers of some species varies widely even within a single inflorescence.

Certain species have mature fruits of a consistent color (*Smilax cumanensis* and *S. maypurensis* with blue to black fruits; *S. pittieriana* and *S. schomburgkiana* with orange fruits), but *S. siphilitica* has fruits that vary from orange to blue-gray. These distinctions are lost upon drying, however, and all fruits from the flora area dry a similar blackish color.

Key to the Species of *Smilax* in the Venezuelan Guayana

1. Lateral shoots (not individual petioles) with 1 scale (sometimes bifid) at the base on the adaxial side (see Fig. 1) 2
1. Lateral shoots with 2 closely placed, overlapping scales at the base on the adaxial side (see Fig. 2) 5
2(1). Basal internode of branches 2–16 cm long, longer than the more distal internodes; peduncle shorter or equal to the petiole length; 1200–2300 m elevation . . . . . *S. staminea*
2. Basal internode of branches 0.5–3 cm long, shorter than the more distal internodes; peduncle usually longer than the petiole, sometimes shorter; 0–1300(–1650) m elevation 3
3(2). Pedicels longer than the peduncle; leaf without spines, blade ovate to elliptic, often drying green, apex acute; Delta Amacuro and Bolívar states, rarely in northern Amazonas . . . . . *S. cumanensis*
3. Pedicels shorter than the peduncle; leaf usually with spines, blade lanceolate to ovate, drying reddish or green, apex mucronate or acute; Amazonas state and rarely in southeastern Bolívar state 4
4(3). Leaf blade lanceolate; apex mucronate or acute, not oblique, drying reddish or green; lower midvein, primary veins, and margin with spines . . . . . *S. lappacea*
4. Leaf blade ovate to rarely lanceolate; apex acute, often oblique, drying reddish; lower midvein and margin often with spines, lower primary veins without spines . . . . . *S. maypurensis*
5(1). Upper branches very scabrous, without spines . . . . . *S. schomburgkiana*
5. Upper branches not scabrous, with or without spines 6
6(5). Stem and midvein pubescent on lower side of leaf . . . . . *S. triplinervia*
6. Stem and lower side of leaf glabrous 7
7(6). Mature leaf blade strongly cordate, 5–20 cm

long, 8–20 cm wide; receptacle usually with many flowers (30–70) . . . . . *S. poeppigii*

7. Mature leaf blade oblong to ovate, 8–35 cm long and 4–10 cm wide; receptacle with < 30 flowers 8

8(7). Mature leaf blade 15–35 cm long, membranous to subcoriaceous, upper surface dull to sublustrous; lower-order venation evident; with or without spines on stem . . . . . *S. siphilitica*

8. Mature leaf blade 8–15 cm long, coriaceous, upper surface lustrous and plane; lower-order venation inconspicuous; stem spineless . . . . . *S. pittieriana*

NEW SYNONYMY

Smilax pittieriana Steyermark, Fieldiana, Bot. 28: 155. 1951. TYPE: Venezuela. Bolívar: mesa between Ptari-tepui and Sororopán-tepui, 1615 m, 15–17 Nov. 1944, [staminate], *Steyermark 60251* (holotype, F; photo, NY).

Smilax auraimensis Steyermark, Bol. Soc. Venez. Ci. Nat. 26: 472. 1966. Syn. nov. TYPE: Venezuela. Bolívar: Sierra Auraima, en la parte terminal norte sobre el margen oeste del Río Paragua, en la zona del raudal de El Perro, 6°32′N, 63°33′W, 400 m, 16 Jan. 1962, *Steyermark 90823* (holotype, VEN; isotypes, NY, US).

Smilax chimantensis Steyermark & Maguire, Mem. New York Bot. Gard. 17(1): 440. 1967. Syn. nov. TYPE: Venezuela. Bolívar: along Río Apacará, Apacará-tepui, Chimantá Massif, 400 m, 25 Mar. 1953, [staminate], *Steyermark 74652* (holotype, NY; isotype, F).

Steyermark's differentiation among *Smilax pittieriana*, *S. auraimensis*, and *S. chimantensis* stems from his confusing designation of a "type" (= holotype) and "co-type" of *S. pittieriana*. The holotype has racemose male inflorescences, two axillary scales at the base of the branches, and ovate, coriaceous leaves with a rounded base and a plane, glossy upper surface. The "co-type," *Steyermark 60251a* (F), has no nomenclatural significance. It has remnants of simple umbellate inflorescences, a single axillary scale at the base of the branches, and narrowly elliptic, membranous leaves with an acute base, a prominently reticulate venation, and a matte upper surface; as such, it corresponds to what we here recognize as *S. staminea*.

Steyermark (1966) differentiated *Smilax auraimensis* and *S. chimantensis* from *S. pittieriana* by their compound inflorescences instead of a simple umbel. In this, he must have been referring to the "co-type" of *S. pittieriana* (actually *S. staminea*), which has remnants of simple umbels. The holotype of *S. pittieriana*, however, has compound inflorescences and cannot be differentiated from the types of *S. auraimensis* or *S. chimantensis* in terms of inflorescence morphology. Steyermark also differentiated *S. chimantensis* from *S. pittieriana* by the following character states: (1) shorter staminate pedicels (6–7 vs. 9–12 mm, but we measured Steyermark's type specimen of *S. pittieriana* and found no pedicel longer than 9 mm); (2) shorter and narrower perianth segments (4–4.5 × 0.6–0.9 vs. 5.2–5.3 × 1.2–1.4 mm, but we measured Steyermark's type specimen of *S. pittieriana* and found the perianth segments to be 4.0–4.5 × 1.0–1.1 mm); (3) immersed vs. non-immersed nerves on the upper surface of the leaf blades; and (4) rounded to slightly cordate instead of subacute to obtuse leaf bases. The differences in leaf morphology are again due to Steyermark's deriving some of the *S. pittieriana* character states from the "co-type" specimen representing *S. staminea*.

Some specimens of *Smilax pittieriana* from the flora area were previously determined as *S. guianensis* Vitman. However, this is a species of uncertain affinity that was based on an illustration by Charles Plumier (1756: tab. 84) of a plant from Martinique; Vitman apparently thought that Plumier's drawing represented the same species as material he examined for his treatment of *Smilax* from French Guiana, explaining his choice of the specific epithet (Vitman, 1791: 422).

Smilax siphilitica Humboldt & Bonpland ex Willdenow, Sp. Pl. 4(2): 780. 1806. TYPE: Venezuela. Amazonas: Río Casiquiare, 1800, *Humboldt & Bonpland 1147* (photo of B holotype at US).

Smilax duidae Steyermark, Fieldiana, Bot. 28: 154. 1951. Syn. nov. TYPE: Venezuela. Amazonas: Cerro Duida, SE-facing slopes along Caño Negro, 260–610 m, 26 Aug. 1944, *Steyermark 58057* (holotype, F; photo, NY).

We cannot find any evidence that Steyermark ever dealt with the name *Smilax siphilitica*, even though the type specimen was collected in southern Venezuela. However, he did contrast *S. duidae*, whose type is also from Amazonas state in Venezuela, with *S. pseudosyphilitica* (type from Prov. Rio de Janeiro, Brazil). In his protologue of *S. duidae*, Steyermark stated that the plants are unarmed, though we found small axillary spines (similar to the spines described in the protologue of *S. siphilitica*) on the type specimen. The type of *S. duidae* is also similar to that of *S. siphilitica* in the coriaceous, oblong, mucronate leaf morphology and the long sheath wings, a character employed by Sipman (1979).

Specimens of *Smilax siphilitica* from the flora area have also been determined as *S. aequatorialis* (type from Prov. Pará, Brazil, and originally de-

scribed as a variety of *S. siphilitica*), *S. febrifuga* (type from Peru), or *S. pseudosyphilitica*. In her recent revision of Brazilian *Smilax*, Andreata (1995) placed both *S. aequatorialis* and *S. pseudosyphilitica* in synonymy under *S. siphilitica*.

Smilax staminea Grisebach, in Martius, Fl. Bras. 3(1): 11. 1842. TYPE: Brazil. "In Brasilia meridionali," *Sello s.n.* (lectotype, G; isolectotypes, K, P not seen). This lectotypification follows Andreata (1995).

Smilax lasseriana Steyermark, Fieldiana, Bot. 28: 154. 1951. Syn. nov. TYPE: Venezuela. Bolívar: Sororopán-tepui, 2255 m, 14 Nov. 1944, *Steyermark 60121* (holotype, F; isotypes, NY, US).

Smilax jauaensis Steyermark & Maguire, Mem. New York Bot. Gard. 23: 854. 1972. Syn. nov. TYPE: Venezuela. Bolívar: Cerro Jaua, 4°45′N, 64°26′W, 1922–2100 m, 22–27 Mar. 1967, *Steyermark 98073* (holotype, VEN).

Smilax staminea forma *obtusata* Steyermark, Fieldiana, Bot. 28: 156. 1951. TYPE: Venezuela. Bolívar: Ptaritepui, 1700–1800 m, 1 Nov. 1945, *Steyermark 59695* (holotype, F; isotype, NY).

The types of *Smilax staminea* and the other two names listed above in synonymy all have a single scale at the lateral shoot base, the basal internode of the lateral shoots longer than the more distal internodes, and similar petiole length and width. Steyermark differentiated *Smilax jauaensis* and *S. lasseriana* from *S. staminea* as having verruculose-tuberculate vs. smooth stems, and he further differentiated *S. lasseriana* from *S. staminea* by its leaf shape (ovate-oblong vs. ovate-lanceolate). Verruculose-tuberculate-stemmed specimens (*Steyermark 98073*, VEN) and smooth-stemmed ones (*Steyermark et al. 109771*, VEN) with otherwise similar inflorescence and vegetative morphology are found together on Cerro Jaua, Bolívar, Venezuela. Leaf morphology and stem texture, as discussed earlier in this paper, are unreliable characters to differentiate species in this complex.

Some specimens of *Smilax staminea* from the flora area have previously been determined as *S. nitida* Grisebach (type from southern Brazil), but Andreata (1995) now regards *S. nitida* as a synonym of *S. rufescens* Grisebach. Outside the flora area, but within Venezuela, specimens that may be referable to *S. staminea* have been collected in the Andes and in the coastal ranges of Distrito Federal and Estado Sucre. This material has mostly been determined as *S. kunthii* Killip & C. V. Morton (= *S. floribunda* Kunth, nom. illegit., type from Ecuador), but a broader examination of specimens will be necessary to determine if this name should also be treated as a synonym of *S. staminea*.

Acknowledgments. We are grateful to Regina Andreata, John Mitchell, and Harrie Sipman for useful comments on an earlier version of the manuscript. We thank Sarah Parsons for the illustrations. This paper is a result of the *Flora of the Venezuelan Guayana* project, which was supported by National Science Foundation grant BSR-9201044 to the second author.

Literature Cited

Andreata, R. H. P. 1980. *Smilax* Linnaeus (Smilacaceae). Ensaio para uma revisão das espécies brasileiras. Arq. Jard. Bot. Rio de Janeiro 24: 179–301.

———. 1995. Revisão das especies brasileiras do gênero *Smilax* L. (Smilacaceae). Ph.D. Thesis, Universidade de São Paulo, Brazil.

Candolle, A. de. 1878. Smilacacées. *In:* A. & C. de Candolle, Monographiae Phanerogamarum Prodromi: 1: 1–217.

Guaglianone, E. R. & S. Gattuso. 1991. Estudios taxonómicos sobre el género *Smilax* (Smilacaceae) I. Bol. Soc. Argent. Bot. 27: 105–129.

Howard, R. A. 1979. The genus *Smilax* in the Lesser Antilles. Taxon 28: 55–58.

Huft, M. J. 1994. Smilacaceae. Pp. 20–25 *in* G. Davidse, M. Sousa, & A. O. Charter (editors), Flora Mesoamericana, Vol. 6, Alismataceae a Cyperaceae. Universidad Nacional Autónoma de México, México, D. F.; Missouri Botanical Garden, St. Louis; The Natural History Museum, London.

Killip, E. P. & C. V. Morton. 1936. A revision of the Mexican and Central American species of *Smilax*. Bot. Maya, Misc. Papers 12: 255–296.

Koyama, T. 1960. Materials toward a monograph of the genus *Smilax*. Quart. J. Taiwan Mus. 13: 1–61.

Mitchell, J. D. 1994. *Smilax saülensis* (Smilacaceae), a new species from French Guiana. Brittonia 46: 225–227.

———. 1997. Smilacaceae. *In:* S. A. Mori, G. Cremers, C. Gracie, J.-J. de Granville, M. Hoff & J. D. Mitchell (editors), Guide to the Vascular Plants of Central French Guiana: Part I: Pteridophytes, Gymnosperms, and Monocotyledons. Mem. New York Bot. Gard. 76: 1–422.

Morton, C. V. 1945. Smilacaceae. Flora of Panama. Ann. Missouri Bot. Gard. 32: 1–105.

———. 1962. A reexamination of Mexican *Smilax* (Smilacaceae). Brittonia 14: 299–309.

Plumier, C. 1756. Plantarum Americanarum. Fasc. 4. Leiden.

Sipman, H. 1979. Liliaceae. *In:* A. L. Stoffers & J. C. Lindeman (editors), Flora of Suriname 5(1): 442–456. Van Eeden fonds, Netherlands.

Steyermark, J. A. 1951. Botanical exploration in Venezuela—1. Fieldiana, Bot. 28: 155.

———. 1966. Botanical novelties from upper Río Paragua, Estado Bolívar, Venezuela. III. Bol. Soc. Venez. Ci. Nat. 26: 472–473.

——— & B. Maguire. 1972. The flora of the Meseta del Cerro Jaua. Mem. New York Bot. Gard. 23: 854–855.

Vitman, F. 1791. Summa Plantarum. Vol. 5. Mediolani, Milan.

Wallace, G. A. 1983. A systematic study of *Smilax* L. section *China* T. Koyama (Smilacaceae) in the United States. Ph.D. Thesis, Clemson University. University Microfilms International, Ann Arbor, Michigan.

Reduction of *Barnardiella*, *Galaxia*, *Gynandriris*, *Hexaglottis*, *Homeria*, and *Roggeveldia* in *Moraea* (Iridaceae: Irideae)

Peter Goldblatt

B. A. Krukoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. *Moraea*, central genus of the Old World and largely African subtribe Homeriinae of Iridaceae tribe Irideae and currently including some 130 species, is understood to be paraphyletic. The remaining genera of Homeriinae, *Barnardiella* (1 sp.), *Galaxia* (15 spp.), *Gynandriris* (9 spp.), *Hexaglottis* (6 spp.), *Homeria* (ca. 32 spp.), and *Roggeveldia* (2 spp.), are each believed to be monophyletic but nested in *Moraea*. Morphological and anatomical evidence showing the likely paraphyly of *Moraea* has now been confirmed by DNA sequence analysis of two chloroplast genes, *trn*L-F and *rbc*L. The species of the six genera nested in *Moraea* are here transferred to the genus. Members of *Galaxia*, *Gynandriris*, *Hexaglottis*, and *Homeria* are provisionally assigned to sections bearing their names. *Barnardiella* is included in section *Moraea*, in which it is evidently closely related to *M. rigidifolia*. The two species of *Roggeveldia* are placed in section *Polyanthes*, and they are believed to be allied to the *M. crispa* group of that section. New combinations or new names are provided for species transferred to *Moraea*. Preliminary data show that the infrageneric classification of *Moraea* will require extensive revision, but until more molecular data are available the current classification of this genus, now including some 200 species, must remain in place.

As currently defined, *Moraea*, the largest genus of Irideae subtribe Homeriinae (Goldblatt, 1990), comprises some 130 species spread throughout sub-Saharan Africa (Goldblatt, 1986a; Goldblatt & Manning, 1995). Other genera of this largely African subtribe are centered in southern Africa (Goldblatt, 1981). *Gynandriris* (9 spp.), however, occurs outside southern Africa, and it has two or possibly three species in the Mediterranean and Middle East (Goldblatt, 1980a). The subtribe comprises some 200 species, and seven genera are usually recognized, these being *Homeria* (including *Sessilistigma*—Goldblatt, 1991) (32 spp.), *Galaxia* (15 spp.), *Hexaglottis* (6 spp.), *Roggeveldia* (2 spp.), and *Barnardiella* (1 sp.) in addition to *Gynandriris* and *Moraea*. Morphological and anatomical data (Goldblatt, 1987; Rudall & Goldblatt, 1993) have suggested that *Moraea* is paraphyletic, and research using DNA sequence analysis has confirmed the paraphyly of the genus (Goldblatt et al., in prep.). DNA sequence analysis of two chloroplast genes, *trn*L-F and *rbc*L, shows that representative species of *Galaxia*, *Gynandriris*, *Hexaglottis*, and *Homeria* are nested in *Moraea* and most closely allied to different species of the genus. *Barnardiella* and *Roggeveldia* can also be confidently allied to particular species or lineages within *Moraea* on morphological and cytological grounds. While other genera of Homeriinae have discrete synapomorphies and can readily be defined, *Moraea* can only be defined by synapomorphies that define Homeriinae. In order to have a phylogenetic classification with *Moraea* monophyletic, the remaining genera of Homeriinae are reduced to synonymy here and their constituent species transferred to *Moraea*.

MORPHOLOGY OF HOMERIINAE

Vegetative morphology. The genera of Homeriinae are defined by two derived features, a cormous rootstock, with the corms covered by fibrous to more or less woody tunics, and a bifacial and dorsiventral leaf. Most other Iridaceae have unifacial, isobilateral leaves, as do *Iris* and *Dietes* (Iridinae) and *Ferraria* (Ferrariinae), the genera believed to be most closely allied to Homeriinae on both morphological and molecular grounds (Goldblatt, 1990, 1991; Souza-Chies et al., 1997). The leaf is specialized in having a closed sheath and a bifacial, usually channeled, blade lacking a midrib. In Homeriinae the unifacial blade ancestral in the family is represented by a short, flattened apical portion. The corm of all Homeriinae consists of a single swollen internode with a terminal apical bud, and on germination roots are produced from the base of the apical bud (Goldblatt, 1990). The corm is entirely axillary in origin and is also distinguished by the presence of persistent tunics of the corm of various texture and color. Tunics are formed from a

cataphyll subtending the axillary bud from which a corm is produced. The ancestral rootstock in Irideae (and probably in all Iridaceae) is a creeping rhizome, and, except for Homeriinae, only *Ferraria* has a corm. In that genus the corm comprises several internodes, the old corms persist, lasting many years (as does a rhizome), and new corms, produced annually, develop from tissue in the base of the flowering stem, incorporating axillary buds in this part of the stem (De Vos, 1979). Corm tunics of *Ferraria* consist of the membranous bases of foliage leaves and are short lived, seldom persisting on the mature corm.

The genera of the subtribe all have this basic vegetative organization, and each is recognized taxonomically largely by its flower, an organ that is central to the pollination strategy of the plant and more directly subject to selection than either fundamental leaf form, surprisingly uniform in the subtribe, or corm features, which vary within limited parameters and show no correlation between habitat and morphology. Corm tunics are the only features useful for recognizing large species clusters throughout Homeriinae. Their utility for phylogenetic interpretation is, however, hindered by their uniqueness within the subtribe so that polarity by outgroup comparison cannot be determined. Objective interpretation of tunic types is sometimes difficult, evidently due to subsequent modification, but their morphology is, nevertheless, useful in studies of the phylogeny of *Moraea*.

Basic flower organization. The ancestral (plesiomorphic) flower type in Homeriinae is similar to that of *Dietes* and *Iris* (Goldblatt, 1990). The outer tepals are larger than the inner and strongly clawed, with the claw appressed to an enlarged petaloid style branch, and the spreading tepal limb is marked with a nectar guide. The inner tepals typically have an ascending claw and spreading limb and lack contrasting markings. Perigonal nectaries are located within the flower at the base of the outer tepals. The style in such flowers is short and much exceeded by three broad style branches against which the upper part of the filaments and the anthers are appressed (Goldblatt, 1986a, 1990). In Homeriinae and *Ferraria* the filaments are united in the lower part, a synapomorphy for the clade, whereas in *Dietes* and *Iris* the stamens are free. The style branches each bear a pair of conspicuous terminal petaloid appendages, the style crests, extending above a transverse stigmatic lobe.

This basic flower organization varies in several ways, and it is the flower alone that defines the several other genera of Homeriinae. In *Gynandriris* the ovary is subsessile, and the flower is raised out of the spathe-enclosed inflorescence on an elongated tubular extension of the ovary (Goldblatt, 1980a). In *Barnardiella, Galaxia, Homeria, Hexaglottis,* and *Roggeveldia* the differences between the outer and inner tepal whorls are weak or absent. The tepal limbs of both whorls may have nectar guides, and both inner and outer tepals may have basal nectaries. Together the tepal claws form a narrow to wide cup surrounding a staminal column that encloses at least part of the style and sometimes the style branches and anthers. This type of flower defines *Homeria* (Goldblatt, 1981) but is not restricted to the genus. *Barnardiella,* like *Gynandriris,* also has a sessile ovary with an elongate tubular upper part (Goldblatt, 1976). *Galaxia* has the *Homeria*-like flower, but plants are acaulescent, and the tepals are basally united to form a tube (Goldblatt, 1979a). *Hexaglottis* has flowers closely resembling some species of *Homeria,* but the anthers diverge, and the style branches are each divided to the base into filiform arms that extend between the anthers (Goldblatt, 1987). In *Roggeveldia* the style arms are filiform but simple and extend between free stamens (Goldblatt, 1979b).

Few of the above specializations are unique within Homeriinae. *Moraea hexaglottis* Goldblatt has a flower like that of *Hexaglottis,* several species of *Moraea* have *Homeria*-like flowers (e.g., *M. crispa* Thunberg (subg. *Moraea*), *M. elsiae* Goldblatt (subg. *Visciramosa*) (Goldblatt, 1986a)), and acaulescence is developed in several species of *Moraea,* evidently unrelated to *Galaxia.* A perianth tube comparable to that in *Galaxia* is present in three species of *Moraea* belonging to two different lineages. Lastly, a sterile, beak-like upper part of the ovary characterizes sections *Deserticola* and *Subracemosae* of *Moraea.* This is a similar, though less pronounced condition than the tubular ovary extension of *Barnardiella* and *Gynandriris.*

Discussion

The basic flower of *Iris* and *Moraea* (and presumably of tribe Irideae) has been said to function as three separate bilabiate units, or meranthia, each consisting of a lower lip with a nectar guide (outer tepal limb), an upper lip (the petaloid style crests), and a gullet (the narrow space enclosed by the outer tepal claw and the lightly appressed style branch) (Müller, 1883; Proctor et al., 1996). Each unit or meranthium bears a close resemblance to the zygomorphic, bilabiate flower of many species of dicot families like Acanthaceae, Lamiaceae, and Scrophulariaceae. Such flowers are usually pollinated by large, long-tongued bees, and both anec-

dotal and documented observations indicate that bees (*Bombus* in the case of *Iris*, Apidae, Anthophoridae, and Mellitidae for *Moraea*) treat the flower in just this way, visiting one bilabiate meranthium of a flower before moving to a meranthium of a different flower (Müller, 1883; Knuth, 1909; Goldblatt et al., 1989). In such flowers the inner tepals apparently serve a minor role in attracting potential pollinators, and they may be erect, spreading, or reduced in various ways. They are absent or vestigial in several species that otherwise maintain the *Iris*-type floral organization and pollination ecology.

Both morphological cladistic analyses (Goldblatt, 1990; Rudall & Goldblatt, 1993) and DNA sequence data (Souza-Chies et al., 1997; Goldblatt et al., in prep.) support the view that this complex, highly specialized flower most probably arose once in tribe Irideae, but the complexity has been lost or modified repeatedly (Goldblatt, 1980b, 1986b). The decrease in size of the style branches and crests, accompanied by the tendency for the inner tepals to resemble the outer in size as well as having a nectar guide at the base of the limb and a nectary at the claw base is evidently an important adaptive shift. Such flowers are adapted for different pollination strategies (Goldblatt & Bernhardt, unpublished).

Species with a short floral cup and prominently displayed anthers (*Barnardiella*, *Hexaglottis*, *Homeria* sect. *Conanthera*, *Moraea pseudospicata* Goldblatt) are pollinated largely by female bees foraging for pollen (Goldblatt, 1981, 1987; Goldblatt & Bernhardt, unpublished). Those with longer tepal claws have larger, wider floral cups, and both nectar and pollen are available to a variety of insects. Such species (e.g., *Homeria comptonii* L. Bolus, *H. elegans* (Jacquin) Sweet, *H. ochroleuca* (Salisbury) Sweet) may be pollinated by a range of different insects, and depending on the type of floral odor and tepal markings, they may be visited by muscid and scathophagid flies, hopliine beetles, and halictid and honey bees (Goldblatt et al., 1998). Thus, what have been considered morphological specializations deserving taxonomic recognition at generic level are now understood to be adaptations for a range of pollination strategies. These adaptations have evolved repeatedly in different lineages (Goldblatt, 1986b), and, I argue, are not *per se* useful for defining genera in Homeriinae. The demonstration that species of *Galaxia*, *Hexaglottis*, and *Homeria* are nested within *Moraea* now makes the reduction of these genera necessary for the maintenance of a phylogenetic classification.

Likewise, the unusual ovary of *Barnardiella* and *Gynandriris* appears to have evolved convergently within *Moraea*. The adaptation, presumably for protection of the ovules, is less strongly developed in some lineages of *Moraea*, and in this light no longer seems as remarkable. It is the climax of a trend within the *Moraea* lineage for concealment and protection of the ovary that has occurred repeatedly, associated either with shorter pedicels (*Moraea* sect. *Deserticola*), the development of an ovary beak (*Moraea* sect. *Subracemosae*), a perianth tube (*Hexaglottis virgata* (Jacquin) Sweet, *M. cooperi* Baker), or a sterile, elongate ovary tube (*Gynandriris*, *Barnardiella*). *Gynandriris* is nested within *Moraea* (Goldblatt et al., in prep.), and *Barnardiella* is almost certainly as well, although it is not closely allied to *Gynandriris*. The flowers of *Barnardiella* externally resemble those of *M. rigidifolia*, and both species have the same basic chromosome number, centric leaves, and sessile lateral branches (Goldblatt, 1976, 1986a), the latter both specialized features. There is no merit in maintaining either *Barnardiella* or *Gynandriris*.

The revised taxonomy of Homeriinae proposed here represents an unconventional treatment of several southern African and one Eurasian genus. It flaunts traditional taxonomy based on Linnaean (phenetic) principles, and it will, for a time, confound and confuse many biologists, naturalists, and ecologists. Nevertheless, the revised classification, which is, as far as knowledge allows, phylogenetic, must be adopted. The reason for this, which is also the ultimate reason for my decision to upset tradition, is that a phylogenetic classification is predictive and the logical goal of systematics.

Nomenclature: New Combinations and New Names

It is premature to attempt a complete reclassification of *Moraea* until a more extensive molecular analysis has been done. The degree of homoplasy in morphological characters renders traditional phylogenetic analysis impractical. The five subgenera of *Moraea* (Goldblatt, 1986a) thus continue to be recognized (Table 1). Four of these, *Monocephalae*, *Visciramosa*, *Vieusseuxia*, and *Grandiflora*, appear to be monophyletic. Subgenus *Moraea* is evidently defined only by plesiomorphic features and is too heterogeneous to be maintained in its present state. It will have to be redefined. Provisionally *Galaxia*, *Gynandriris*, *Hexaglottis*, and *Homeria* are treated as new sections of subgenus *Moraea* (Table 1). *Barnardiella* is referred to section *Moraea* and *Roggeveldia* to section *Polyanthes* of subgenus *Moraea*.

Table 1. Outline of the current classification of *Moraea* based on the system by Goldblatt (1986). Generic synonyms are indicated in parentheses under the appropriate section or subgenus.

Subg. *Moraea*
  Sect. *Moraea*
    (*Barnardiella* Goldblatt)
  Sect. *Deserticola* Goldblatt
  Sect. *Subracemosae* Baker
  Sect. *Polyanthes* Goldblatt
    (*Roggeveldia* Goldblatt)
  Sect. *Acaules* (Baker) Goldblatt
  Sect. *Homeria* (Ventenat) Goldblatt
    (*Homeria* Ventenat; *Sessilistigma* Goldblatt)
  Sect. *Hexaglottis* (Ventenat) Goldblatt
    (*Hexaglottis* Ventenat)
  Sect. *Gynandriris* (Parlatore) Goldblatt
    (*Gynandriris* Parlatore)
  Sect. *Tubiflora* Goldblatt
    (*Helixyra* Salisbury ex N. E. Brown; *Rheome* Goldblatt)
  Sect. *Flexuosae* Goldblatt
  Sect. *Galaxia* (Thunberg) Goldblatt
    (*Galaxia* Thunberg)
      Ser. *Galaxia*
      Ser. *Eurystigma* (Goldblatt) Goldblatt
Subg. *Visciramosa* Goldblatt
Subg. *Monocephalae* (Baker) Goldblatt
Subg. *Vieusseuxia* (Delaroche) Goldblatt
  (*Vieusseuxia* Delaroche)
  Sect. *Thomasiae* Goldblatt
  Sect. *Vieusseuxia*
Subg. *Grandiflora* Goldblatt
  (*Hymenostigma* Hochstetter)

In the list that follows all the species of the genera reduced to sectional rank are listed for completeness, including those that have valid names in *Moraea*. Complete lists of species assigned at the time to sections *Moraea* and *Polyanthes* are provided by Goldblatt (1986).

Moraea Miller, Fig. pl. Gard. Dict. 2: 159. 1766 (as *Morea*). TYPE: *Moraea vegeta* L.

Galaxia Thunberg, Gen. pl. nov. 50. 1782. Syn. nov. TYPE: *Galaxia graminea* L. fil. (lectotype, designated by E. P. Phillips (1951)).

Homeria Ventenat, Dec. gen. nov. no. 2. 1808. Syn. nov. TYPE: *Homeria collina* (Thunberg) Ventenat.

Hexaglottis Ventenat, Dec. gen. nov. no. 3. 1808. Syn. nov. TYPE: *Hexaglottis longifolia* (Jacquin) Salisbury (lectotype, designated by Lewis (1959)).

Gynandriris Parlatore, Nuov. gen. sp. 49. 1854. Syn. nov. TYPE: *Gynandriris sisyrinchium* (L.) Parlatore.

Barnardiella Goldblatt, Ann. Missouri Bot. Gard. 63: 312. 1976. Syn. nov. TYPE: *Barnardiella spiralis* (N. E. Brown) Goldblatt.

Roggeveldia Goldblatt, Ann. Missouri Bot. Gard. 66: 840. 1979. Syn. nov. TYPE: *Roggeveldia fistulosa* Goldblatt.

Section Moraea

Moraea herrei (L. Bolus) Goldblatt, comb. nov. Basionym: *Homeria herrei* L. Bolus, S. African Gard. 211: 367. 1931.

Other names: *Moraea spiralis* Baker, Handb. Irid. 55. 1892, nom. illeg., non *M. spiralis* L. fil. (1782). *Helixyra spiralis* N. E. Brown, Trans. Roy. Soc. S. Africa 17: 349. 1929. *Barnardiella spiralis* (N. E. Brown) Goldblatt, Ann. Missouri Bot. Gard. 63: 312. 1976.

Section Polyanthes Goldblatt (1976)

Moraea fistulosa (Goldblatt) Goldblatt, comb. nov. Basionym: *Roggeveldia fistulosa* Goldblatt, Ann. Missouri Bot. Gard. 66: 840. 1979.

M. monticola Goldblatt, nom. nov. Replaced name: *Roggeveldia montana* Goldblatt, S. African J. Bot. 58: 211. 1992, non *M. montana* Schlechter (1900) (= *M. lurida* Ker Gawler).

Section Homeria (Ventenat) Goldblatt, comb. et stat. nov. Basionym: *Homeria* Ventenat, Dec. Gen. Nov. no. 2. 1808.

Moraea aspera Goldblatt, nom. nov. Replaced name: *Homeria spiralis* L. Bolus, J. Bot. 69: 260. 1931, non *M. spiralis* L. fil. (1782) (= *Aristea spiralis* (L. fil.) Ker Gawler).

M. autumnalis (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria autumnalis* Goldblatt, Ann. Missouri Bot. Gard. 68: 467. 1981.

M. bifida (L. Bolus) Goldblatt, comb. nov. Basionym: *Homeria bifida* L. Bolus, Ann. Bolus Herb. 3: 10. 1920.

M. brachygyne (Schlechter) Goldblatt, comb. nov. Basionym: *Homeria brachygyne* Schlechter, Bot. Jahrb. Syst. 27: 94. 1900.

M. britteniae (L. Bolus) Goldblatt, comb. nov. Basionym: *Homeria britteniae* L. Bolus, J. Bot. 69: 11. 1931.

M. bulbillifera (G. J. Lewis) Goldblatt, comb. nov. Basionym: *Homeria bulbillifera* G. J. Lewis, J. S. African Bot. 11: 117. 1945.

M. cedarmonticola Goldblatt, nom. nov. Replaced name: *Homeria cedarmontana* Goldblatt, Ann. Missouri Bot. Gard. 68: 451. 1981, non *M. cedarmontana* (Goldblatt) Goldblatt (1998).

M. collina Thunberg, *Moraea* 11. 1787.

Other name: *Homeria collina* (Thunberg) Salisbury, Trans. Hort. Soc. London 1: 307. 1812.

M. comptonii (L. Bolus) Goldblatt, comb. nov. Basionym: *Homeria comptonii* L. Bolus, S. African Gard. 19: 294. 1929.

M. cookii (L. Bolus) Goldblatt, comb. nov. Basionym: *Homeria cookii* L. Bolus, Fl. Pl. S. Africa 8: pl. 366. 1928.

M. demissa Goldblatt, nom. nov. Replaced name: *Homeria tenuis* Schlechter, Bot. Jahrb. Syst. 27: 95. 1900, non *M. tenuis* Ker Gawler (1802) (= *M. unguiculata* Ker Gawler).

M. elegans Jacquin, Pl. hort. schoenbr. 1: 6. 1797.

Other name: *Homeria elegans* (Jacquin) Sweet, Hort. brit. 395. 1826.

M. fenestrata (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria fenestrata* Goldblatt, Ann. Missouri Bot. Gard. 68: 491. 1981.

M. flaccida Sweet, Hort. brit. 395. 1826.

Other name: *Homeria flaccida* (Sweet) Steud., Nomencl. Bot. ed. 2, 2: 160. 1840.

M. flavescens (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria flavescens* Goldblatt, Ann. Missouri Bot. Gard. 68: 481. 1981.

M. fragrans Goldblatt, nom. nov. Replaced name: *Homeria odorata* L. Bolus, Bull. Misc. Inform. 1932: 326. 1932, non *M. odorata* G. J. Lewis (1941) (= *M. viscaria* (L. fil.) Ker Gawler).

M. fuscomontana (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria fuscomontana* Goldblatt, Ann. Missouri Bot. Gard. 68: 497. 1981.

M. karroica Goldblatt, nov. nov. Replaced name: *Homeria tricolor* G. J. Lewis, S. African Gard. 23: 266. 1933, non *M. tricolor* Andrews (1880).

M. knersvlaktensis Goldblatt, nom. nov. Replaced name: *Homeria ramosissima* Schlechter, Bot. Jahrb. Syst. 22: 95. 1900, non *Moraea ramosissima* (L. fil.) Druce (1916).

M. longistyla (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria longistyla* Goldblatt, Ann. Missouri Bot. Gard. 68: 475. 1981.

M. louisabolusiae Goldblatt, nom. nov. Replaced name: *Homeria bolusiae* Goldblatt, Ann. Missouri Bot. Gard. 68: 438. 1981, non *M. bolusii* Baker (1892).

M. marlothii (L. Bolus) Goldblatt, comb. nov. Basionym: *Homeria marlothii* L. Bolus, S. African Gard. 19: 320. 1929.

M. miniata Andrews, Bot. Repos. 5: pl. 404. 1804.

Other name: *Homeria miniata* (Andrews) Sweet, Brit. Fl. Gard. 2: pl. 152. 1826.

M. minor Ecklon, Topogr. verz. Pflanzensamml. 15. 1827.

Other name: *Homeria minor* (Ecklon) Goldblatt, Ann. Missouri Bot. Gard. 68: 473. 1981.

M. ochroleuca (Salisbury) Drapiez, Dict. Class. Nat. Sci. 4: 447. 1841.

Other name: *Homeria ochroleuca* Salisbury, Trans. Hort. Soc. London 1: 308. 1812.

M. pallida (Baker) Goldblatt, comb. nov. Basionym: *Homeria pallida* Baker, Handb. Irid. 75. 1892.

M. patens (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria patens* Goldblatt, Ann. Missouri Bot. Gard. 68: 477. 1981.

M. pendula (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria pendula* Goldblatt, Ann. Missouri Bot. Gard. 68: 488. 1981.

M. pyrophila Goldblatt, nom. nov. Replaced name: *Homeria galpinii* L. Bolus, Fl. Pl. S. Africa 10: pl. 417. 1931, non *M. galpinii* (Baker) N. E. Brown (1929).

M. radians (Goldblatt) Goldblatt, comb. nov. Basionym: *Sessilistigma radians* Goldblatt, J. S. African Bot. 50: 156. 1984. *Homeria radians* (Goldblatt) Goldblatt, Contr. Bolus Herb. 13: 51. 1991.

M. reflexa Goldblatt, nom. nov. Replaced name: *Homeria hantamensis* Goldblatt & J. C. Manning, Fl. Pl. Africa 55: pl. 2128. 1997, non *M. hantamensis* Klatt (1882) (= *M. ciliata* (L. fil.) Ker Gawler).

M. schlechteri (L. Bolus) Goldblatt, comb. nov. Basionym: *Homeria schlechteri* L. Bolus, Fl. Pl. S. Africa 8: sub pl. 306. 1928.

M. serratostyla (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria serratostyla* Goldblatt, S. African J. Bot. 58: 212. 1992.

M. vallisbelli (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria vallisbelli* Goldblatt, Ann. Missouri Bot. Gard. 68: 479. 1981.

Section Hexaglottis (Ventenat) Goldblatt comb. et stat. nov. Basionym: *Hexaglottis* Ventenat, Dec. gen. nov. 6. 1808.

Moraea brevituba (Goldblatt) Goldblatt, comb. nov. Basionym: *Hexaglottis brevituba* Goldblatt, Ann. Missouri Bot. Gard. 74: 562. 1987.

M. lewisiae (Goldblatt) Goldblatt, comb. nov. Basionym: *Hexaglottis lewisiae* Goldblatt, S. African J. Bot. 37: 234. 1971.

M. longifolia (Jacquin) Persoon, Syn. pl. 1: 49. 1805. Basionym: *Ixia longifolia* Jacquin, Hort. bot. vindob. 3: 47 & pl. 90. 1776. *Hexaglottis longifolia* (Jacquin) Salisbury, Trans. Hort. Soc. 1: 313. 1918. 1812, non *M. longifolia* (Schneevoogt) Sweet (1830) (= *M. fugax* (Delaroche) Jacquin (1776)).

M. namaquana (Goldblatt) Goldblatt, comb. nov. Basionym: *Hexaglottis namaquana* Goldblatt, Ann. Missouri Bot. Gard. 74: 554. 1987.

M. riparia (Goldblatt) Goldblatt, comb. nov. Basionym: *Hexaglottis riparia* Goldblatt, Ann. Missouri Bot. Gard. 74: 559. 1987.

M. virgata Jacquin, Icon. pl. rar. 2: pl. 228. 1791 et Collecteana 3: 194. 1791.

Other name: *Hexaglottis virgata* (Jacquin) Sweet, Hort. Brit. ed. 2, 498. 1830.

Section Gynandriris (Parlatore) Goldblatt, comb. et stat. nov. Basionym: *Gynandriris* Parlatore, Nuov. Gen. Sp. 49. 1854.

Moraea australis Goldblatt, comb. nov. Basionym: *Gynandriris australis* Goldblatt, Bot. Not. 133: 251. 1980.

M. cedarmontana (Goldblatt) Goldblatt, comb. nov. Basionym: *Gynandriris cedarmontana* Goldblatt, Bot. Not. 133: 250. 1980.

M. contorta Goldblatt, nom. nov. Replaced name: *Gynandriris anomala* Goldblatt, Bot. Not. 133: 250. 1980, non *M. anomala* G. J. Lewis (1940).

M. hesperantha (Goldblatt) Goldblatt, comb. nov. Basionym: *Gynandriris hesperantha* Goldblatt, Bot. Not. 133: 248. 1980.

M. mediterranea Goldblatt, nom. nov. Replaced name: *Gynandriris monophylla* Boissier & Heldreich ex Klatt, Linnaea 34: 578. 1866, non *M. monophylla* Baker (1906) (= *M. tripetala* (L. fil.) Ker Gawler).

M. pritzeliana Diels, Bot. Jahrb. Syst. 44: 17. 1900.

Other name: *Gynandriris pritzeliana* (Diels) Goldblatt, Bot. Not. 133: 248. 1980.

M. setifolia (L. fil.) Druce, Bot. Exch. Club Brit. Isles Rep. 1916: 363. 1916.

Other name: *Gynandriris setifolia* (L. fil.) Foster, Contr. Gray Herb. 114: 40. 1936.

M. simulans Baker, Handb. Irid. 58. 1892.

Other name: *Gynandriris simulans* (Baker) R. C. Foster, Contr. Gray Herb. 114: 40. 1936.

M. sisyrinchium (L.) Ker Gawler, Ann. Bot. (König & Sims) 1: 201. 1805.

Other names: *Gynandriris sisyrinchium* (L.) Parlatore, Nuov. gen. sp. 49. 1854; *Iris sisyrinchium* L., Sp. Pl. 40. 1753.

Section Galaxia (Thunberg) Goldblatt, comb. et stat. nov. Basionym: *Galaxia* Thunberg, Gen. pl. nov. 50. 1782.

Series Galaxia

Moraea albiflora (G. J. Lewis) Goldblatt, comb. nov. Basionym: *Galaxia albiflora* G. J. Lewis, J. S. African Bot. 7: 44. 1941.

M. angulata Goldblatt, nom. nov. Replaced name: *Galaxia alata* Goldblatt, J. S. African Bot. 45: 418. 1979, non *M. alata* Vahl (1804) (= *Sisyrinchium* sp.).

M. fugacissima (L. fil.) Goldblatt, comb. nov. Basionym: *Ixia fugacissima* L. fil., Suppl. Pl. 94. 1782. *Galaxia fugacissima* (L. fil.) Druce, Bot. Exch. Club Brit. Isles Rep. 1916: 624. 1916.

M. kamiesensis Goldblatt, nom. nov. Replaced name: *Galaxia grandiflora* Andrews, Bot. Repos. pl. 164. 1801, non *M. grandiflora* Sesse & Moçino (1893) (= *Tigridia* sp.).

M. luteoalba (Goldblatt) Goldblatt, comb. nov. Basionym: *Galaxia luteoalba* Goldblatt, J. S. African Bot. 45: 410. 1979.

M. ovalifolia Goldblatt, nom. nov. Replaced name: *Galaxia ovata* Thunberg, Gen. pl. nov. 50. 1782, non *M. ovata* Thunberg (1800).

M. pilifolia Goldblatt, nom. nov. Replaced name: *Galaxia ciliata* Persoon, Syn. pl. 1: 41. 1805, non *M. ciliata* (L. fil.) Ker Gawler (1805).

M. stagnalis (Goldblatt) Goldblatt, comb. nov. Basionym: *Galaxia stagnalis* Goldblatt, J. S. African Bot. 45: 414. 1979.

Series Eurystigma (Goldblatt) Goldblatt, comb. et stat. nov. Basionym: *Galaxia* subg. *Eurystigma* Goldblatt, J. S. African Bot. 45: 398. 1979.

M. barnardiella Goldblatt, nom. nov. Replaced name: *Galaxia barnardii* Goldblatt, J. S. African Bot. 45: 398. 1979, non *Moraea barnardii* L. Bolus (1933).

M. citrina (G. J. Lewis) Goldblatt, comb. nov. Basionym: *Galaxia citrina* G. J. Lewis, J. S. African Bot. 4: 6. 1938.

M. fenestralis (Goldblatt & E. G. H. Oliver) Goldblatt, comb. nov. Basionym: *Galaxia fenestralis* Goldblatt & E. G. H. Oliver, Novon 3: 406. 1993.

M. kamiesmontana (Goldblatt) Goldblatt, comb. nov. Basionym: *Galaxia kamiesmontana* Goldblatt, Ann. Missouri Bot. Gard. 71: 1084. 1984.

M. minima Goldblatt, nom. nov. Replaced name: *Galaxia parva* Goldblatt, Ann. Missouri Bot. Gard. 71: 1085. 1984, non *M. parva* N. E. Brown (1929).

M. variabilis (G. J. Lewis) Goldblatt, comb. nov. Basionym: *Galaxia variabilis* G. J. Lewis, J. S. African Bot. 4: 6. 1938.

M. versicolor (Salisbury ex Klatt) Goldblatt, comb. nov. Basionym: *Galaxia versicolor* Salisbury ex Klatt, Linnaea 32: 783. 1863.

Literature Cited

De Vos, M. P. 1979. The African genus *Ferraria*. J. S. African Bot. 43: 295–375.

Goldblatt, P. 1976. *Barnardiella*: A new genus of the Iridaceae and its relationships to *Gynandriris* and *Moraea*. Ann. Missouri. Bot. Gard. 63: 309–313.

———. 1979a. Biology and systematics of *Galaxia* (Iridaceae). J. S. African Bot. 45: 385–423.

———. 1979b. *Roggeveldia*, a new genus of southern African Iridaceae–Irideae. Ann. Missouri Bot. Gard. 66: 839–844.

———. 1980a. Systematics of *Gynandriris* (Iridaceae), a Mediterranean–southern African disjunct. Bot. Not. 133: 239–260.

———. 1980b. Redefinition of *Homeria* and *Moraea* (Iridaceae) in the light of biosystematic data, with *Rheome* gen. nov. Bot. Not. 133: 85–95.

———. 1981. Systematics and biology of *Homeria* (Iridaceae). Ann. Missouri Bot. Gard. 68: 413–503.

———. 1986a. The Moraeas of Southern Africa. Ann. Kirstenbosch Bot. Gard. 14: 1–224.

———. 1986b. Convergent evolution of the *Homeria* flower type in six new species of *Moraea* (Iridaceae) in southern Africa. Ann. Missouri Bot. Gard. 73: 102–116.

———. 1987. Systematics of the southern African genus *Hexaglottis* (Iridaceae–Iridoideae). Ann. Missouri Bot. Gard. 74: 542–569.

———. 1990. Phylogeny and classification of Iridaceae. Ann. Missouri Bot. Gard. 77: 607–627.

———. 1991. An overview of the systematics, phylogeny and biology of the southern African Iridaceae. Contr. Bolus Herb. 13: 1–74.

——— & J. C. Manning. 1995. New species of southern African *Moraea* (Iridaceae–Iridoideae) and the reduction of *Rheome*. Novon 5: 262–269.

———, P. Bernhardt & J. C. Manning. 1989. Notes on the pollination mechanisms of *Moraea inclinata* and *M. brevistyla* (Iridaceae). Pl. Syst. Evol. 163: 201–209.

———, ——— & ———. 1998. Pollination of petaloid geophytes by monkey beetles (Scarabaeidae: Rutelinae: Hopliini) in southern Africa. Ann. Missouri Bot. Gard. 85: 215–230.

Knuth, P. 1909. Handbook of Flower Pollination. 3. [Translated by J. R. Ainsworth Davis.] Clarendon Press, Oxford.

Lewis, G. J. 1959. South African Iridaceae. A revision of *Hexaglottis*. J. S. African Bot. 25: 215–230.

Müller, H. 1883. The Fertilisation of Flowers. MacMillan, London.

Phillips, E. P. 1951. Genera of South African Plants. Botanical Research Institute, Pretoria.

Proctor, M., P. Yeo & A. Lack. 1996. The Natural History of Pollination. Timber Press, Portland, Oregon.

Rudall, P. & P. Goldblatt. 1993. Leaf anatomy and systematics of Homeriinae (Iridaceae). Bot. J. Linn. Soc. 111: 379–397.

Souza-Chies, T. T., G. Bittar, S. Nadot, L. Carter, E. Besin & B. Lejeune. 1997. Phylogenetic analysis of Iridaceae with parsimony and distance methods using the plastid gene *rps*4. Pl. Syst. Evol. 204: 109–123.

Agapetes subsessilifolia (Ericaceae), a New Species from the Eastern Himalayas

Huang Su-hua
Department of Biology, Yunnan University, Kunming, Yunnan 650091, People's Republic of China

Sun Hang and Zhou Zhe-kun
Herbarium, Kunming Institute of Botany, The Chinese Academy of Sciences, Kunming, Yunnan 650204, People's Republic of China

ABSTRACT. *Agapetes subsessilifolia* S. H. Huang, H. Sun & Z. K. Zhou, a new species of Ericaceae from the Gorge of Yalu Tsangpo, Medog, Tibet, in the eastern Himalayas, is described and illustrated.

During a botanical expedition to the big bend gorge of Yalu Tsangpo of southeastern Tibet, the following distinct new species of Ericaceae was discovered.

Agapetes subsessilifolia S. H. Huang, H. Sun & Z. K. Zhou, sp. nov. TYPE: China. Tibet: Medog, Hammi, 1600 m, Oct. 1992, *Sun Hang et al. 0997* (holotype, KUN). Figure 1.

Species *Agapetes pseudo-griffithii* Airy-Shaw affinis, sed petiolis valde brevis, pedicellis apice leviter in clavatos expansis, calycis segmentis anguste triangulatis, corollis cylindricis, 2.5 cm longis differt.

Frutex epiphyticus, rami graciles, brunnei, glabri, leviter angulati. Folia subopposita vel in ramulis congestis, coriacea, ovato-oblonga vel late elliptica, 7.5–14 cm longa, 3–3.5 cm lata, apice longe acuminata vel caudata, basi rotundata, margine subintegra, utrique glabra, costa utrinque prominula. Nervis lateralibus obscuris; petiolus valde brevis, 2–3 mm longus, diam. 3 mm, glaber. Inflorescentiae corymbiformes, 3–5 florae, axillares vel in ramis veteribus, pedunculo 2.5–3.5 cm longo; pedicelli graciles, 3 cm longi, apice leviter clavati expansi; receptaculum 4 mm longum, 3 mm latum; calycis segmenta 5, anguste triangularia, 5 mm longa, 4 mm lata, acuta. Corolla cylindrica, rubra, transversaliter V-formiter purpureo-striata, 2.5 cm longa, supra leviter ampliata, 1 cm lata, lobis 5, stamina 10, deltoidea; filamenta valde brevia, ca. 1 mm longa, leviter puberula; thecae 5–6 mm longae, dense papillosae, rostris 16 mm longis, dorso ecalcaratis apice poris dehiscentibus; discus annulatus, ca. 0.5 mm altus; ovarium 5-loculare. Stylus cylindricus, 2.5 cm longus; Stigma truncatum, glabrum. Frutus ignotus.

Epiphytic shrub, glabrous. Leaves subopposite, clustered at the top of branches, coriaceous, ovate-oblong to widely elliptic, 7.5–14 × 3–5.5 cm, apex narrowly acuminate, base rounded, glabrous, margins entire; petioles very short, 2–3 mm long, or subsessile, glabrous. Corymbs 3–5-flowered, axillary on old branches, peduncle 2.5–3.5 cm, pedicels 3 cm, glabrous, clavate-shaped at apex. Sepals narrowly triangular, 5 × 4 mm, acute. Corolla tubular, red with V-shaped purplish striated, 2.5 × 1 cm, triangular lobes. Filaments very short, ca. 1 mm, slightly pubescent; thecas 5–6 mm; rostrum 16 mm long, glabrous, not spurred. Disk annular, 0.5 mm tall; ovary 5-locular, style 2.5 cm, stigma truncate, glabrous. Fruit unknown.

Agapetes subsessiflifolia is similar to *A. pseudo-griffithii* Airy-Shaw but differs in having very short or subsessile petioles; pedicels that are clavate-shaped at the apex; calyx lobes narrowly triangular; and cylindrical corollas to 2.5 cm long.

Paratypes. CHINA. **Tibet:** Medog, Gelin, 1750 m, Dec. 1992, *Sun Hang et al. 2537* (KUN), *2661* (KUN); Buqiong Lake, 1600 m, Nov. 1992, *Sun Hang et al. 1140* (KUN).

Acknowledgments. We are very grateful to the National Natural Science Foundation of China for supporting this expediton to Tibet; to Wu Xi-lin for the excellent illustration, and to Zhu Guanghua for reviewing the manuscript.

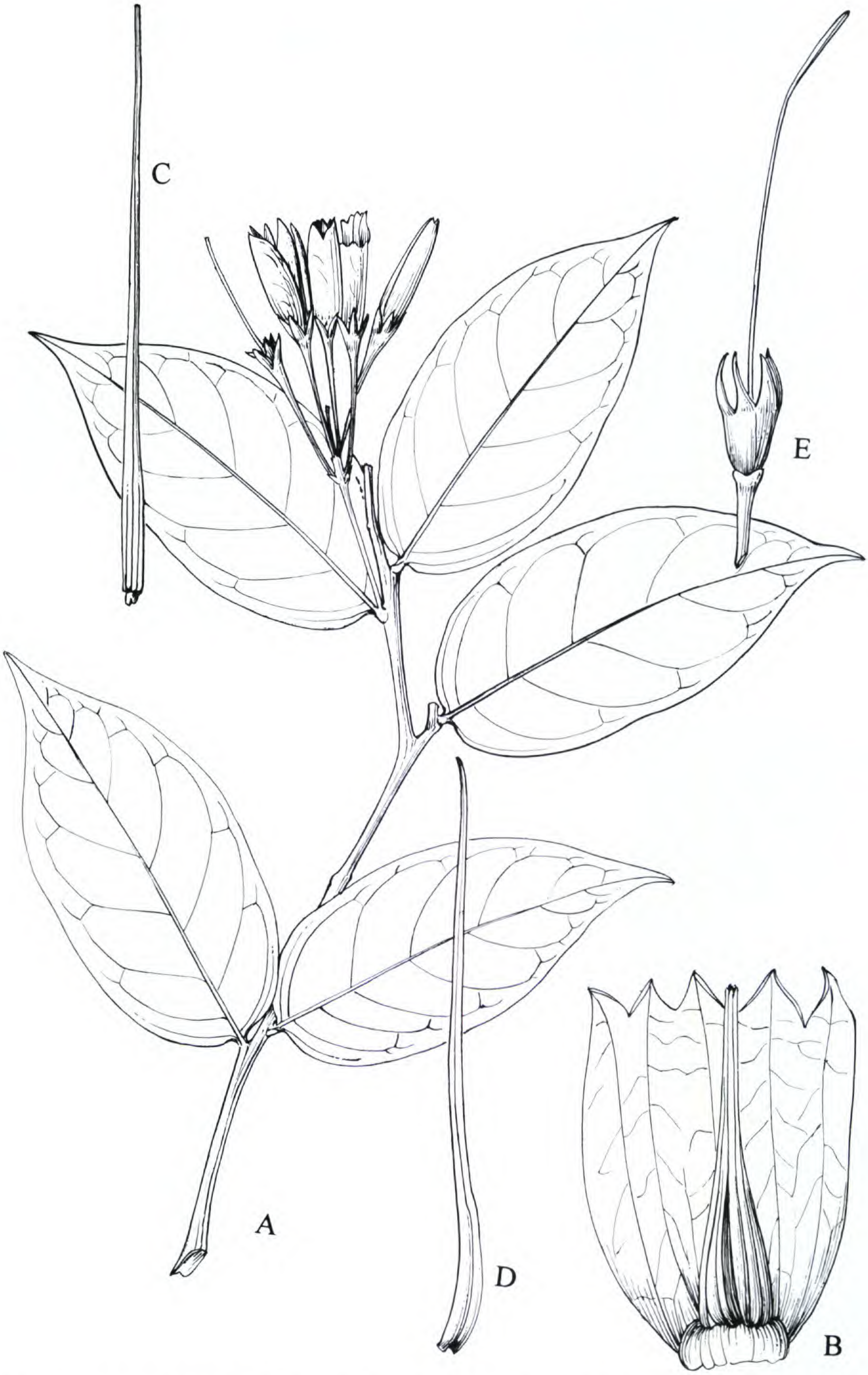


Figure 1. *Agapetes subsessilifolia* S. H. Huang, H. Sun & Z. K. Zhou. —A. Flowering branch (×1). —B. Opened corolla, adaxial view showing androecium (×3). —C. Stamen, abaxial view (×3). —D. Stamen, lateral view (×3). —E. Calyx and persistent style (×3).

The Mexican *Chaptalia hintonii* is a *Gerbera* (Asteraceae, Mutisieae)

Liliana Katinas

Departamento Científico de Plantas Vasculares, Museo de La Plata, Paseo del Bosque, 1900 La Plata, Argentina

ABSTRACT. *Chaptalia hintonii* Bullock, endemic to Mexico, has floral characters that indicate affinities to the genus *Gerbera*. A new nomenclatural combination, *Gerbera hintonii* (Bullock) Katinas, is proposed, and a redescription and illustration of the species is presented. The differences between *Chaptalia* and *Gerbera*, and the relationships between *G. hintonii* and the allied sections of *Gerbera*, are discussed.

A systematic revision in progress of the genus *Chaptalia* has shown that the Mexican *Chaptalia hintonii* (Bullock, 1936) exhibits morphological characters that separate this taxon from *Chaptalia* and approach those of *Gerbera*.

Gerbera (Asteraceae, Mutisieae), with 28 species, belongs to the Mutisiinae, a predominantly American subtribe, although a quarter of its species occur outside of the Americas (Cabrera, 1977). Within the subtribe, *Gerbera*, together with *Chaptalia*, *Leibnitzia*, *Lulia*, *Perdicium*, *Trichocline*, and *Uechtritzia*, forms a natural group, called either the *Gerbera*-complex or the scapose-complex (Jeffrey, 1967a; Hansen, 1990). However, the generic boundaries between *Gerbera* and some of the other genera of this complex have been problematic. The main morphological characters used to separate them are the types and number of series of the ray florets, the presence or absence of staminodes (Burkart, 1944), the texture of the pappus (Jeffrey, 1967a), the apex of the cypselas being either truncate or rostrate (Zardini, 1975), and the types of cypsela hairs (Jeffrey, 1967a; Nesom, 1983; Hansen, 1990).

Thus, the generic lines between *Gerbera* and *Chaptalia* are vaguely drawn. Jeffrey (1967a) accepted an Old World genus *Gerbera* and a New World genus *Chaptalia*. Hansen (1985a, b, 1988) revised the sections of *Gerbera*, although he did not establish a clear-cut differentiation between *Gerbera* and *Chaptalia*. The first, partial, systematic treatment of *Chaptalia* is that of Burkart (1944) who, focusing on the Argentine species, recognized seven sections in the genus. He analyzed some characters to distinguish *Chaptalia* and *Gerbera*, i.e., ray florets bilabiate, in one series, with staminodes; cypselas without a rostrum; and leaves densely pubescent above. Burkart recognized exceptions in most of these characters, and postulated that some species of *Chaptalia* could be a point of union with other, related genera, e.g., his section *Archichaptalia* with *Trichocline*. Years later, some species from section *Archichaptalia* and from other sections were transferred to *Leibnitzia* (Nesom, 1983). Recently, Nesom (1995), in a revision of the North American and continental Central American species of *Chaptalia*, corroborated that the generic boundaries between *Chaptalia* and the Old World *Gerbera* are problematic. In his study, Nesom found specimens that produce small, abortive stamens, a character that deviates from the traditional definition of *Chaptalia*.

The new species *Chaptalia hintonii*, from Mexico, was described by Bullock (1936) and distinguished from *C. nutans* (L.) H. Polakowsky by its long-petiolate leaves. Subsequently, *C. hintonii* was included in taxonomic (Nesom, 1995) and floristic treatments (e.g., Matuda, 1958; Martínez & Matuda, 1979) of *Chaptalia*. In the most recent treatment of *Chaptalia*, *C. hintonii* was placed in section *Chaptalia* together with five other species on the basis of its ebracteate scapes, heads nodding in bud, disk florets with sterile ovaries, and relatively broad ligules with a purple, abaxial, midstrip (Nesom, 1995). From the members of this section, the morphologically closest to *C. hintonii* is *C. lyratifolia* A. Burkart by virtue of the pinnatifid shape of the leaves and the developed inner lip of the ray florets (bilabiate). *Chaptalia hintonii*, however, differs from this and from the other species of the section by the presence of staminodes in the ray florets. The characteristic lack of staminodes in *Chaptalia* and their presence in *Gerbera* led me to place *C. hintonii* in the genus *Gerbera*.

Gerbera differs from *Chaptalia* by having all its florets bilabiate (outer lip tridentate, inner lip bipartite), its ray florets generally with a showy outer lip conspicuously surpassing the involucre, and the

staminodes in the ray florets present (lacking in *G. parva* N. E. Brown, occasionally in *G. piloselloides* (L.) A. H. G. de Cassini). A series of inner ray florets, present in some species of *Gerbera*, are morphologically similar to the outer ones, but reduced in size. Occasionally, one may find in a capitulum some ray florets with the inner lip reduced, giving the corolla a ligulate appearance. Some species of *Gerbera* exhibit short, U- or cup-shaped style branches (Hansen, 1990).

The outer ray florets of *Chaptalia* are ligulate or with a scarcely developed inner lip, and are generally shorter than the involucre or surpass it by only a few millimeters. The corolla of the inner ray florets is filiform and reduced (bilabiate, tubulose, or ligulate), irregularly lobed at the apex, and generally much shorter than the style. Both the outer and inner ray florets completely lack staminodes. The disk florets of *Chaptalia* are bilabiate or tubulose, and the style in *Chaptalia* is either scarcely cleft at the apex, or is deeply divided into linear branches; the U-shaped morphology of the style branches of *Gerbera* is not present.

Occasionally, *Chaptalia* species exhibit floral characters that approach those of *Gerbera*, showing the close relationship between the genera. For instance, in some species of *Chaptalia* the corollas of the ray florets have relatively broad ligules (*C. exscapa* (C. H. Persoon) J. G. Baker var. *chilensis* (DC.) A. Burkart, *Chaptalia* sect. *Chaptalia*), or bilabiate ray florets (*C. lyratifolia*). However, the lack of staminodes in all these species is a character that distinguishes them from *Gerbera*.

The development of staminodes, together with the type of cypsela hairs, appears to be a key character in the evolution of the *Gerbera*-complex. The phylogenetic analysis of the *Gerbera*-complex performed by Hansen (1990) shows that there is a reduction series from the plesiomorphic condition "sterile anthers" containing a few pollen grains (*Lulia, Trichocline, Uechtritzia*, somewhat more reduced in *Gerbera* sect. *Isanthus*) to total loss of anthers. The apomorphic condition is represented by a reduction to thread-like or vestigial staminodes (*Gerbera* sects. *Lasiopus* (A. H. G. de Cassini) Schultz-Bipontinus, *Pseudoseris* (H. E. Baillon) C. Jeffrey, and *Piloselloides* C. F. Lessing, and *Leibnitzia*) or to their complete absence (*Chaptalia, Gerbera* sect. *Parva* H. V. Hansen, *Perdicium*).

The twin hairs on the cypselas are also of diagnostic importance in the *Gerbera*-complex (Jeffrey, 1967a; Hansen, 1990) and differentiate *Chaptalia* and *Gerbera* to some degree. Restricted to Asteraceae, twin hairs ("Zwillingshaare" of Hess, 1938) are composed of two reduced basal cells and two cylindrical hair cells. According to the classification of the cypsela hairs in the Nassauviinae (Freire & Katinas, 1995), the closest subtribe to the Mutisiinae (Cabrera, 1977; Jansen & Palmer, 1988; Bremer, 1994), *Gerbera* has twin hairs of subtypes *basic* (70–140 μm long), *rounded* (30–40 μm long), and *filiform* (220–350 μm long), while *Chaptalia*, which also has subtypes *basic* and *rounded*, plus *asymmetric* (with one hair cell shorter, 100–110 μm long), completely lacks subtype *filiform*. The short trichomes (*basic, rounded, asymmetric*) give the cypselas a papillose appearance, whereas the cypselas with long (*filiform*) trichomes are villous.

Finally, most chromosome counts have shown *Gerbera* to have $n = 25$ ($2n = 50$), and *Chaptalia*

Table 1. Comparison of significant morphological characters and distribution of *Gerbera hintonii* with those of *Gerbera* sects. *Lasiopus*, *Piloselloides*, and *Pseudoseris*.

	Gerbera hintonii	*G.* sect. *Lasiopus*	*G.* sect. *Piloselloides*	*G.* sect. *Pseudoseris*
Scapes	not widened below the capitula	not widened below the capitula	widened below the capitula	not widened below the capitula
Series of ray florets (outer-inner ray florets)	2	2	2	1 (only outer) or 2
Length of outer ray florets	3–7 mm more than the involucre	up to 20 mm more than the involucre	2–3 mm more than the involucre	up to 8mm more than the involucre
Staminodes	present	present	present (rarely absent)	present
Cypselas	shortly rostrate	shortly rostrate	longly rostrate	shortly rostrate
Types of cypsela twin hairs	*basic; rounded*	*filiform*	*basic*	*filiform* or cypselas glabrous
Distribution	Mexico	Africa	Africa and Asia	Africa (Madagascar)

$n = 24$ ($2n = 48$) (e.g., Moore, 1973). There have been found, however, reports of $n = 25$ and $2n = 50$ in *Chaptalia nutans* (Teppner & Tropper, 1984; for this species there are also many reports of $n = 24$, $2n = 48$), and $n = 24$ in two species of *Gerbera* (Gupta et al., 1989; Platonova et al., 1985). Additional data may provide valuable information on this character in the future.

Chaptalia hintonii is much closer to *Gerbera* in its floral characteristics. Thus, all its florets are biabiate, the outer ray florets conspicuously surpass the involucre, and the ray florets possess staminodes (Fig. 1C), all characters described and illustrated by Bullock (1936) himself in the original description of *C. hintonii.* These staminodes would correspond to the thread-like ones pointed out by Hansen (1990). Occasionally there are mixed in the same capitulum inner ray florets with staminodes and inner ray florets without staminodes. With the typical U-shaped morphology of the style branches, as in some species of *Gerbera,* all these floral characters have now led to the transfer of this species to *Gerbera.*

Gerbera hintonii can be related to *Gerbera* sect. *Lasiopus,* sect. *Piloselloides* or sect. *Pseudoseris* because of its ebracteate scapes, and the biseriate ray florets, i.e., with both outer and inner ray florets. When one compares *G. hintonii* to species of these three sections (Table 1), the species of section *Piloselloides* seem to be the most closely related by virtue of the length of the outer ray florets and the type of pubescence on the cypselas. On the other hand, *G. hintonii* does not have the scape widened below the capitulum, as in section *Piloselloides,* and its cypselas are shortly rostrate. It is interesting to note that Burkart (1944) pointed to the relationship of *Chaptalia* to *Gerbera piloselloides* (sect. *Piloselloides*) as a case of evolutionary convergence. Jeffrey (1967b), when raising section *Piloselloides* to the rank of genus, also emphasized a close morphological alliance between this taxon and the New World genus *Chaptalia.* Thus, the relationship of *G. hintonii* with *Gerbera* sect. *Piloselloides* suggested here is consistent with these hypotheses.

From a distributional point of view (Fig. 2), the presence of a species of *Gerbera* in Mexico represents the second record of the genus in the Americas. *Gerbera* was long considered exclusively African and Asiatic (cf. Hansen, 1985a, b, 1988), until Zardini (1974) transferred the Peruvian and Ecuadorian *Trichocline hieracioides* (Kunth) Ferreyra to *Gerbera* (*G. hieracioides*). This species was considered as a probable monotypic genus of the Mutisiinae by Hansen (1990), with a morphology intermediate between *Gerbera* and *Trichocline:* style arms with a tufted mat of hairs (as in *Gerbera gossypina* (Royle) G. Beauverd of sect. *Isanthus*), cypselas with a terminal callus (as in *Trichocline*), and multicellular, rigid, conical hairs on the ray tube (as in *Trichocline*). The presence of "subinflate" cypsela hairs (i.e., length mean = 143 μm and width mean = 26 μm) was considered by Hansen as unique within the *Gerbera*-complex. The length of the "subinflate" hairs would correspond to the length of the *basic* cypsela hairs (140 μm) described above. The presence of staminodes (more reduced than in *Trichocline*) and the rostrate cypselas, which characterize this South American species, suggest its inclusion in *Gerbera* and thus represents the first record of this genus in the Americas. In spite of the *filiform* cypsela hairs that characterize *Gerbera* sect. *Isanthus, G. hieracioides* can be related to it by its recurved leaf margins bent backward, bracteate scapes, and uniseriate rays with well developed staminodes. Hansen (1985b) proposed that it is likely that *Gerbera* has followed two lines of evolution, one having bracteate scapes and only one series of rays (e.g., sect. *Isanthus*), and another with bracteate scapes and developing two series of rays (e.g., sect. *Piloselloides*). Thus, the Peruvian-Ecuadorian and the Mexican species of *Gerbera* do not appear to be closely related.

The presence in Ecuador, Peru, and Mexico of a mainly African and Asiatic genus such as *Gerbera* raises interesting questions about the biogeography of *Gerbera* and the whole *Gerbera*-complex. It has been suggested that vicariant processes rather than dispersal events could have played a major role in the distribution of this complex of genera (Hansen, 1990). On the other hand, other authors consider that there are many such Afro-American disjunct taxa that suggest long-distance dispersal, perhaps more commonly in Mid or Late Tertiary times when the distances between the continents were not quite as great as they are today (Iltis, 1967).

The following new combination, with a redescription of *G. hintonii,* is made here:

Gerbera hintonii (Bullock) Katinas, comb. nov. Basionym: *Chaptalia hintoni* Bullock, in Hooker's Icon. Pl., ser. 5, 4: 1, tab. 3346. 1936. TYPE: Mexico. México: District Temascaltepec, Nanchititla, cliffs, 1 May 1933, *G. B. Hinton 3098* (holotype, K not seen, photograph LP; isotypes, MO, US). Figure 1.

Perennial, scapose herb, 12.5–33 cm high; rhizomes 1–4.5 cm long. Leaves in a basal rosette, pinnatisect, commonly with only the upper lobe de-

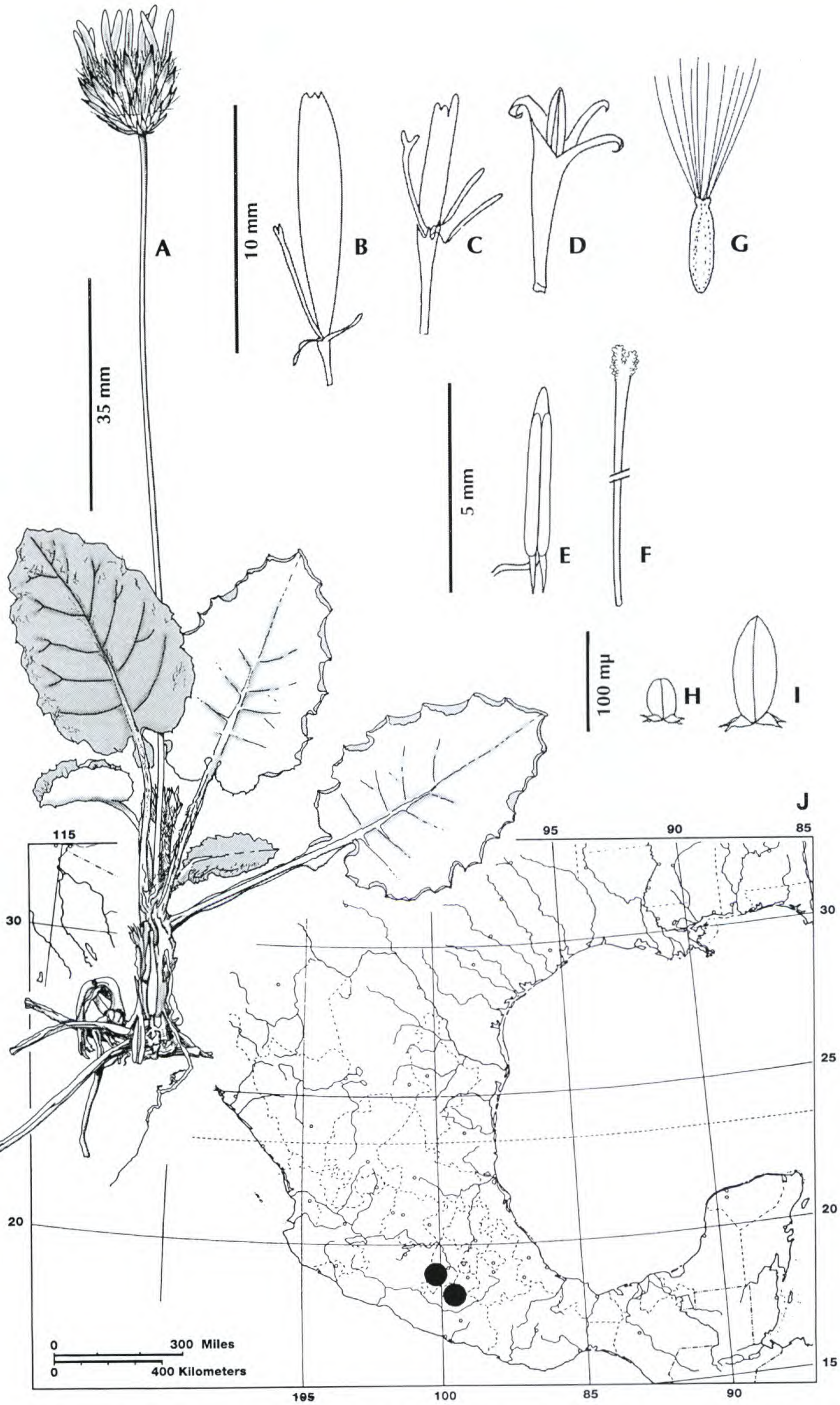


Figure 1. *Gerbera hintonii* (Bullock) Katinas. —A. Habit. —B. Outer ray floret. —C. Inner ray floret with staminodes. D–F. Disk floret. —D. Corolla. —E. Stamen. —F. Style. —G. Cypsela. H, I. Cypsela hairs. —H. *Rounded* twin hair. —I. *Basic* twin hair. —J. Distribution in Mexico. A–G. *Hinton 3465* (US). H, I. *Rzedowski 25225* (WIS).

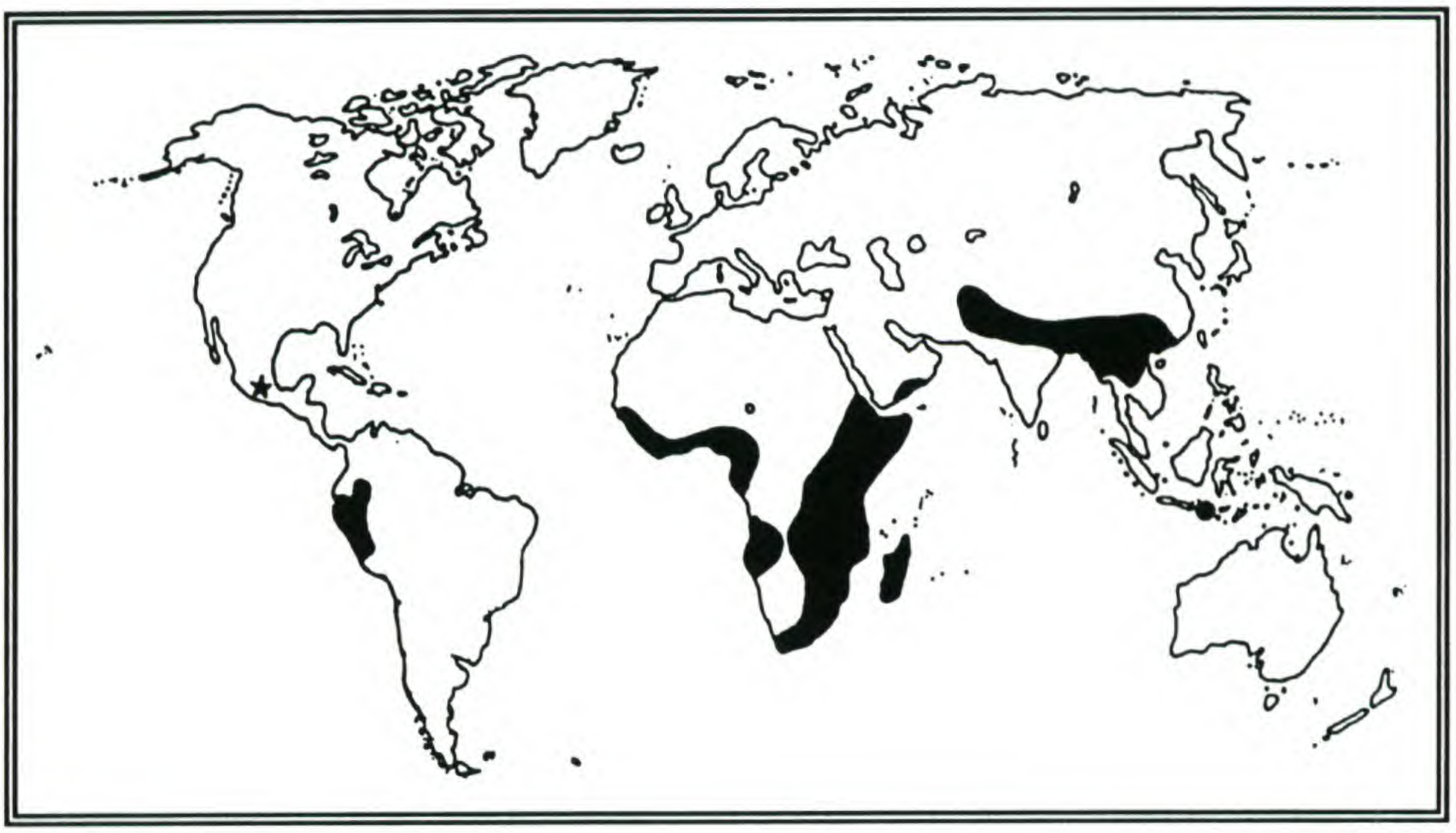


Figure 2. General distribution of the genus *Gerbera*. Star = *G. hintonii*.

veloped and the rest of the blade reduced to a wing along the pseudopetiole, or to 1–2 minute lateral lobes; upper lobe 3.5–11 cm long, 1–9.5 cm wide, elliptic to ovate, planate, acute to obtuse at the apex, cordate at the base, crenate-mucronulate, glabrous or araneose-pubescent above, yellowish green tomentose beneath; pseudopetiole 1.5–12 cm long. Scapes 11–32 cm long, monocephalous, ebracteate, not widened below the capitula, tomentose. Capitula 18–20 mm long, 12–20 mm wide, turbinate, radiate, heterogamous. Receptacle alveolate, naked, glabrous. Involucre bracts 4–5-seriate, imbricate, increasing in size inward, purple at the margins, apex and midrib, glabrous or pubescent: first series 3–5 mm long, 0.3–0.5 mm wide, linear; second series 4–8 mm long, 0.4–1 mm wide, linear; third series 7–11 mm long, 0.8–1.2 mm wide, linear-oblong; fourth and fifth series 9–14 mm long, 1 mm wide, oblong, scarious at the margins. Florets 50–60, trimorphic, bilabiate, with outer lip tridentate, inner lip bipartite and occasionally reduced, white (yellowish when dry), glabrous; outer ray florets pistillate, longer than the involucre, with tube 3–5 mm long, with outer lip 9–13 mm long, inner lip 3–5 mm long, style 6.5–9 mm long, branches 0.3–0.7 mm long, the florets occasionally with staminodes; inner ray florets few, functionally pistillate, tube 1–3 mm long, outer lip 5–7 mm long, inner lip 0.8–2.5 mm long, style 6–7.5 mm long, branches 0.2–0.8 mm long, staminodes 1–3, vestigial, 1–3 mm long; disk florets functionally staminate (ovaries sterile, empty), with tube 1.5–3 mm long, outer lip 3–3.5 mm long, inner lip 3 mm long, style 7–8.5 mm long, branches 0.3–0.4 mm long; stamens caudate, with entire, oblong apical appendage, with anthers 3.5–7 mm long, tails 0.3–1.5 mm long. Cypselas 2.5–4 mm long, ellipsoid, cylindric, attenuate at the apex or with a constricted neck, 5-ribbed, papillose pubescent (*basic* and *rounded* twin hairs). Pappus white, caducous, the bristles scabrous, 4–8 mm long.

Distribution and ecology. On rocky cliffs, in woods or grassy places, endemic to the states of Guerrero and México, in southern Mexico, at 1800–2160 m. Flowering from March to November.

In an observation on the morphological characters, included in the protologue to *Chaptalia hintonii*, Bullock (1936) named as "type" the specimen *Hinton 3465*. It was probably a lapse in Bullock's writing because the type specimen (holotype) was previously pointed out by him in the exsiccata as: "*Hinton 3098* (type)."

Use of the epithet *hintonii* instead of *hintoni* as originally published by Bullock merits brief comment. As the Latin gender of the name "Hinton" is masculine and singular, the ending of the genitive case is "ii" according to Article 60, Recommendation 60c of the *International Code of Botanical Nomenclature* (Greuter et al., 1994).

Paratypes. MEXICO. District Temascaltepec, Nanchititla, 28 Aug. 1935, *Hinton 8228* (MO), 15 Oct. 1935, *Hinton et al. 8562* (MO, US); La Sierrita, 4 Mar. 1933, *Hinton 3465* (MO, US).

Other specimens examined. MEXICO. **Guerrero:** 3 km al SE de Tetipac, sobre la carretera a Taxco, 21 Nov.

1967, *Rzedowski 25225* (US, WIS); 3.5 km SSE of Tetipac, on road from Taxco, 14 Aug. 1981, *Nesom 4409* (US).

Acknowledgments. I thank Theodore Cochrane, Jorge V. Crisci, Hugh H. Iltis, and Mark A. Wetter for comments and valuable suggestions on an earlier version of the manuscript, and curators of above-noted herbaria for loans of specimens. I express my appreciation to Hans V. Hansen, Gunnar Harling, and Guy Nesom for their insightful comments and stimulating ideas. Kandis Elliot provided the illustrations. I am especially grateful to the Department of Botany, University of Wisconsin-Madison, and its splendid herbarium, for the use of their facilities.

Literature Cited

Bremer, K. 1994. Asteraceae: Cladistics and Classification, Timber Press, Portland, Oregon.

Bullock, A. A. 1936. *Chaptalia hintoni* Bullock. Hooker's Icon. Pl. , ser. 5, 4: 1, tab. 3346.

Burkart, A. 1944. Estudio del género de Compuestas *Chaptalia* con especial referencia a las especies Argentinas. Darwiniana 6: 505–594.

Cabrera, A. L. 1977. Mutisieae—Systematic review. Pp. 1039–1066 *in* V. H. Heywood, J. G. Harborne & B. L. Turner (editors), The Biology and Chemistry of the Compositae, Vol. 2. Academic Press, London.

Freire, S. E. & L. Katinas. 1995. Morphology and ontogeny of the cypsela hairs of Nassauviinae (Asteraceae, Mutisieae). Pp. 107–143 *in* D. J. N. Hind, C. Jeffrey & G. V. Pope (editors), Advances in Compositae Systematics. Royal Botanic Gardens, Kew.

Greuter, W., F. R. Barrie, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva, P. Trehane & J. McNeill (Editors). 1994. International Code of Botanical Nomenclature (Tokyo Code). Regnum Veg. 131.

Gupta, R. C., B. S. Gill & R. K. Gag. 1989. Chromosomal conspectus of western Himalayan Compositae. J. Cytol. Genet. 24: 96–105.

Hansen, H. V. 1985a. Notes on *Gerbera* sect. *Pseudoseris* (Compositae–Mutisieae). Nordic J. Bot. 5: 451–453.

———. 1985b. A taxonomic revision of the genus *Gerbera* (Compositae–Mutisieae) sections *Gerbera*, *Parva*, *Piloselloides* (in Africa), and *Lasiopus*. Opera Bot. 78: 5–36.

———. 1988. A taxonomic revision of the genera *Gerbera* sect. *Isanthus*, *Leibnitzia* (in Asia), and *Uechtritzia* (Compositae, Mutisieae). Nordic J. Bot. 8: 61–76.

———. 1990. Phylogenetic studies in the *Gerbera*-complex (Compositae, tribe Mutisieae, subtribe Mutisiinae). Nordic J. Bot. 9: 469–485.

Hess, R. 1938. Vergleichende Untersuchungen über die Zwillingshaare der Kompositen. Bot. Jahrb. Syst. 68: 435–496.

Iltis, H. H. 1967. Studies in the Capparidaceae. XI: *Cleome afrospina*, a tropical African endemic with neotropical affinities. Amer. J. Bot. 54: 953–962.

Jansen, R. K. & D. Palmer. 1988. Phylogenetic implications of chloroplast DNA restriction site variation in the Mutisieae (Asteraceae). Amer. J. Bot. 75: 753–766.

Jeffrey, C. 1967a. Notes on Compositae II. The Mutisieae in east tropical Africa. Kew Bull. 21: 177–223.

———. 1967b. *Piloselloides*. Bull. Jard. Bot. État. 37, Suppl.: 1180.

Martínez, M. & E. Matuda. 1979. Flora del estado de México. Las Compuestas 2: 210–321. Biblioteca Enciclopédica del Estado de México, Distrito Federal, Mexico.

Matuda, E. 1958. Las Compuestas del Estado de México. Gobierno del Estado de México, Dirección de Recursos Naturales, Toluca, Mexico.

Moore, R. J. (Editor). 1973. Index to Plant Chromosome Numbers 1967–1971. Regnum Veg. 90: 383, 400.

Nesom, G. L. 1983. Biology and taxonomy of American *Leibnitzia* (Asteraceae: Mutisieae). Brittonia 35: 126–139.

———. 1995. Revision of *Chaptalia* (Asteraceae: Mutisieae) from North America and continental Central America. Phytologia 78: 153–188.

Platonova, R. N., L. V. Abysova & A. G. Susarenko. 1985. Microsporogenesis and gametogenesis in *Gerbera* (*Gerbera jamesonii*). Dokl. Akad. Nauk SSSR 5: 666–673.

Teppner, H. & S. Tropper. 1984. Chromosomen und Chromatin-typen bei *Chaptalia nutans* (Asteraceae–Mutisieae). Kurzfassungen (der Beiträge). Botaniker-Tagung, Deutscher Botanische Gesellschaft Wien, September 1984: 8.

Zardini, E. M. 1974. Sobre la presencia del género *Gerbera* en América. Bol. Soc. Argent. Bot. 16: 103–108.

———. 1975. Revisión del género *Trichocline* (Compositae). Darwiniana 19: 618–733.

A New Species of *Calyptranthes* (Myrtaceae) from Coastal Forests of Brazil

Maria Lúcia Kawasaki

Herbário, Instituto de Botânica de São Paulo, Caixa Postal 4005, 01061-970, São Paulo, SP, Brazil

ABSTRACT. *Calyptranthes dryadica*, a new species of Myrtaceae from the coastal forests of São Paulo, characterized by few-flowered panicles with large buds, is described and illustrated.

The botanically little known coastal forests of Brazil are one of the most threatened ecosystems in the world. Floristic studies in the Ecological Reserve of Juréia-Itatins, in the southern coastal forests of the state of São Paulo, have shown that the Myrtaceae are the dominant family in number of species, one of which is here recognized as new to science.

Calyptranthes dryadica M. L. Kawasaki, sp. nov. TYPE: Brazil. São Paulo: Iguape, Ecological Reserve of Juréia-Itatins, trail of the fig tree, 14 Mar. 1990 (fl), *L. Rossi et al. 542* (holotype, SP; isotypes, MBM, MO). Figure 1.

A *Calyptranthe grandifolia* O. Berg differt: inflorescentiis brevibus paucifloris (nec multifloris), alabastris majoribus apiculatis (nec obtusis), foliis chartaceis (nec coriaceis), latioribus usque 2-plo (nec 2.25–3.5) longioribus. A *Calyptranthe lucida* DC. differt: inflorescentiis brevibus paucifloris (nec multifloris), tomentosis (nec glabris), alabastris et foliis majoribus.

Small tree, 1.5–4 m tall; hairs where present reddish to yellowish brown, dibrachiate; young branchlets sparsely pubescent. *Leaf blades* widely elliptic to elliptic, 10–17 × 5–9 cm, up to twice as long as wide, chartaceous, discolorous, the upper surface glabrous, with impressed glandular dots, drying olive-green, the lower surface puberulous to glabrous, with salient glandular dots, drying yellowish green; apex acute to acuminate; base cuneate; midvein sulcate above, convex below; lateral veins 12–14 pairs, convex on both surfaces; marginal veins 2, the inner one 2–3 mm from the margin; petiole 8–15 mm long, puberulous, canaliculate. *Paired panicles* terminal, few-flowered, with ca. 10–20 flowers per panicle, 3–8 cm long, the axes tomentose, with 1 to 2 pairs of opposite lateral branches, the flowers clustered in threes near the tips; peduncles 2–3 cm long; bracts lanceolate, 8–10 mm long, pubescent, deciduous; bracteoles linear, ca. 2 mm long, early deciduous; buds pyriform, ca. 6–8 mm long, tomentose, apiculate, sessile; petals absent; hypanthium prolonged ca. 2 mm above the ovary, glabrous within; style 7–8 mm long; stamens ca. 200–250; filaments 5–8 mm long; anthers ellipsoid, 0.5–0.8 mm long, bearing one apical gland; ovary 2-locular with 2 ovules in each locule. *Fruits* globose, dark wine-red to black, 1.5–2 cm diam., sparsely pubescent to glabrous; seeds 1–3, to 1.5 cm long; testa membranous; embryo myrcioid.

The specific epithet refers to one of the five phytogeografic areas (from the Greek *druas* and the Latin *dryas*, wood nymph) recognized by Martius (1906). *Calyptranthes dryadica* is known only from the coastal forests of the Ecological Reserve of Juréia-Itatins. It was collected in flower from March to April and in fruit from June to December.

Calyptranthes dryadica is characterized by: the few-flowered inflorescences with 1–2 pairs of lateral branches, large, apiculate buds (6–8 mm long), and chartaceous leaves, drying green, up to twice as long as wide. Among other species of *Calyptranthes* found in the coastal forests, it might be confused with *C. grandifolia* O. Berg and *C. lucida* DC., two distinctive species with wider ranges and many-flowered inflorescences, with three or more pairs of lateral branches.

In *Calyptranthes grandifolia*, a species known from northeastern to southern Brazil, the buds are 4–5 mm long, rounded or obscurely apiculate, and the leaves are coriaceous, drying brown, 2.25–3.5 times as long as wide. In *C. lucida*, a species known from northern South America (McVaugh, 1958) to southern Brazil (Legrand, 1962), the inflorescences are glabrous, the buds are 2–3 mm long, and the leaves are smaller (usually up to 12 cm long) and 2.25–3 times as long as wide.

Paratypes. BRAZIL. **São Paulo:** Iguape, Ecological Reserve of Juréia-Itatins, 24 Apr. 1990 (fl), *E. L. M. Catharino et al. 1342* (SP), 14 Dec. 1990 (fr), *M. P. Costa et al. 52* (SP), 21 Sep. 1990 (fr), *S. J. Gomes da Silva et al.*

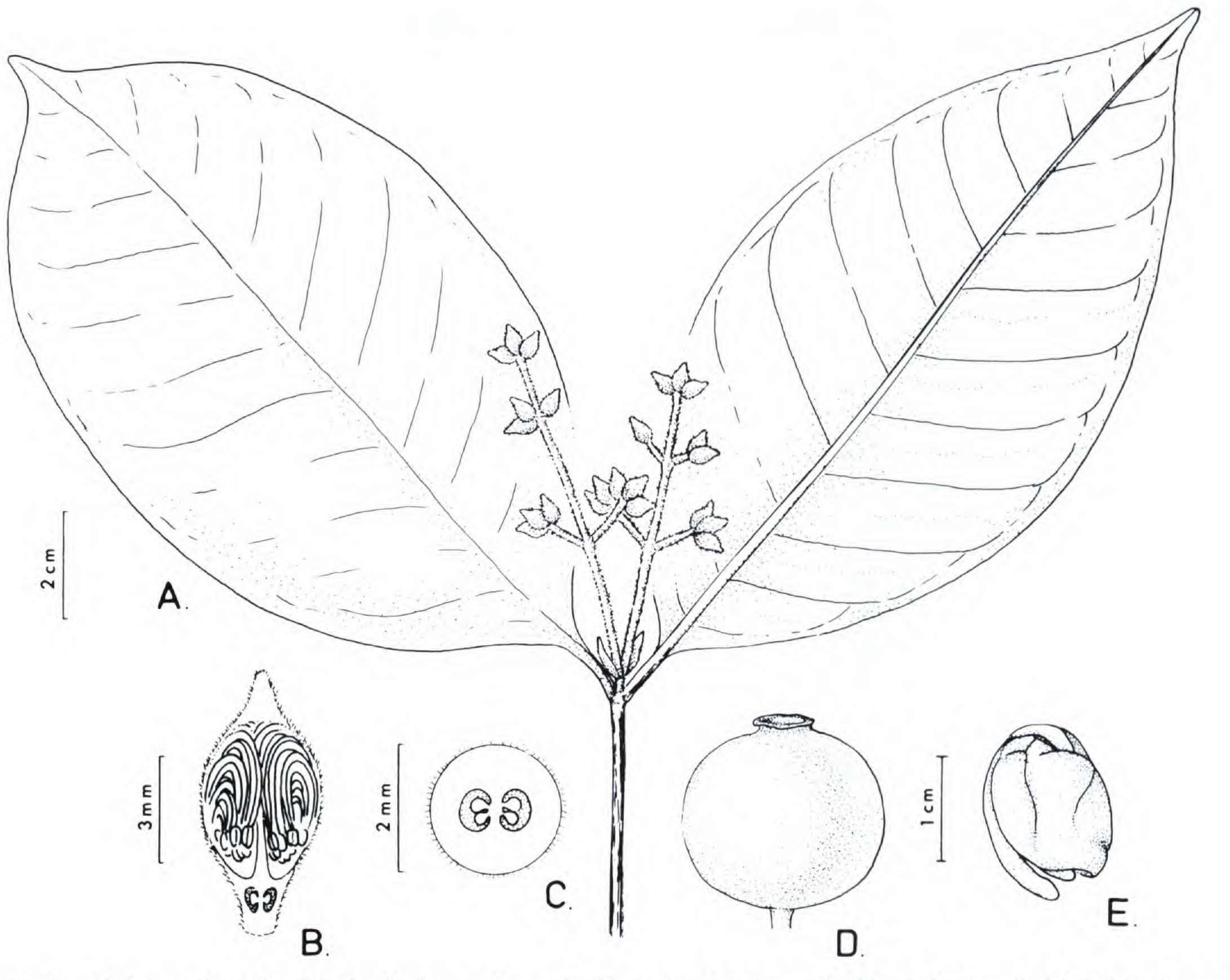


Figure 1. *Calyptranthes dryadica* M. L. Kawasaki. —A. Flowering branch. —B. Flower bud. —C. Medial section of ovary. —D. Fruit. —E. Embryo. (A–C, *Rossi et al. 542*; D, E, *Costa et al. 52*.)

66 (SP), 15 Aug. 1991 (fr), *D. F. Pereira et al. 61* (SP), 12 June 1991 (fr), *L. Rossi et al. 907* (SP).

Acknowledgments. This study was supported by the John D. and Catherine T. MacArthur Foundation, *Floristic Studies at the Ecological Reserve of Juréia-Itatins* project. I thank Nancy Hensold and Alessandro Rapini for helpful comments, the two reviewers, and Lucia Rossi for suggesting the specific epithet.

Literature Cited

Legrand, C. D. 1962. El género *Calyptranthes* en el Brasil austral. Lilloa 31: 183–206.

Martius, C. F. P. von. 1906. Tabulae physiognomicae. Brasiliae regiones iconibus expressas descripsit deque vegetatione illius terra uberius. Fl. bras. 1(1): i–cx.

McVaugh, R. 1958. Myrtaceae. *In:* The Botany of the Guayana Highland—Part III. Mem. New York Bot. Gard. 10: 61–91.

Supplemental Notes on New World *Xyris* (Xyridaceae)

Robert Kral

Herbarium (VDB), Vanderbilt University, Box 1705, Sta. B, Nashville, Tennessee 37235, U.S.A.

ABSTRACT. Of South American *Xyris* sent to the author for determination by the Missouri Botanical Garden and The New York Botanical Garden, six appear to be new species: three (*X. boliviana*, *X. guillenii*, and *X. subasperula*, sent from MO) are recent collections from eastern Bolivia; two (*X. amorimii* and *X. ferreirae*, sent from NY) are Brazilian, from Bahia and Amazonas, respectively. A sixth (*X. gongylospica*) was collected from the Guayana Highlands of Bolívar, Venezuela. All are described and illustrated, and their relationships are discussed.

Of the South American *Xyris* recently sent to me for determination from the Missouri Botanical Garden and The New York Botanical Garden, five are distinct when one applies existing treatments (Kral, 1988, 1994; Maguire & Smith, 1964; Smith & Downs, 1968) to them. These, and yet another that I found during a trip to the Guayana Highlands of Edo. Bolívar, Venezuela, are presented below. The kindness of curators at the above-mentioned institutions, together with that of the original collectors of the Brazilian and Venezuelan material, is hereby gratefully acknowledged.

1. Xyris amorimii Kral, sp. nov. TYPE: Brazil. Bahia: Mun. Morro do Chapeau, Estrada p/o Morro da Torre de transmissão, ca. de 10 km a partir da Sede do Municipio, ca. 1100 msm, campo rupestre, 22 Fevereiro 1993, *A. M. A. Amorim, A. M. V. de Carvalho, J. G. Jardim & J. R. da Silva 1048* (holotype, CEPEC; isotypes, NY, VDB). Figure 1.

Habitu et spica *X. minarum* Seubert et affinibus similis, praecipue differt sed basibus foliorum minus dilatatis, bracteis (dum similiter scariosis) et sepalis lateralis distaliter fimbriatis, trichomatibus elongatis, pallidis, crispatis.

Perennial, caespitose, smooth, 5–7 dm high. Roots slender, fibrous. Stems short. Principal foliage leaves in narrow fans, 16–26 dm long, longer than the scape sheaths; sheaths entire, carinate, thin, prominently costate, shining, brown to pale red-brown or stramineous, about as long as the blades, distally papillose, at base gradually dilating, upleaf gradually narrowed, eligulate or short-liguled, flattened, narrowly linear, 1–2 mm wide, olivaceous, prominently few-nerved, minutely papillose; apices gradually narrowed, narrowly acute, slightly thickened; margins thin, entire. Scape sheaths red-brown toward base, toward apex open with elongate blades. Scapes straight, slightly twisted, terete, ca. 0.5 mm thick, at apex few-costate, minutely papillate, olivaceous. Spikes multiflorous, turbinate at anthesis, broadly ovoid afterward, 0.7–1 cm long; bracts erect to ascending, subequal, loosely spirally imbricate, broadly oblong to narrowly ovate, 5.5–6.5 mm long, thin, pale brown, papillate, scarious, the margins toward apex densely white-villous, the dorsal areas prominent, pale green, punctate. Sterile bracts few, with continuous, narrow dorsal areas; fertile bracts emarginate, the dorsal areas narrowly triangular, up to 4 mm long. Lateral sepals free, equilateral, lanceolate, curved, ca. 5 mm long; keel narrow, firm, papillate from base to tip; margins scarious, white-villous toward apex. Petal blades obovate, ca. 4 mm long, acute, undulate-margined, yellow. Staminodia bibrachiate, the branches densely long-penicillate. Anthers oblong, ca. 1.5 mm long, deeply emarginate and sagittate; filaments 0.5–0.7 mm long. Capsule ellipsoid, ca. 3 mm long; placenta central. Seeds numerous, ellipsoid to ovoid, ca. 0.4 mm long, finely spirally multiribbed, translucent.

Distribution. Known only from the type collection.

This species is distinctive both in foliage and inflorescence, but it is difficult to determine its alliances. In habit and spike it resembles *Xyris minarum* Seubert and related taxa, yet its leaf bases are less dilated; its spike bracts, while similarly scarious, are fringed distally with long, pale, crisped hairs, a character likewise found on its lateral sepals. These two latter features are unique in that complex.

2. Xyris boliviana Kral, sp. nov. TYPE: Bolivia. Santa Cruz: Velasco Parque Nacional Noel Kempff M., pampa inundada, orilla Rio Itenez, 13°32′37″S, 61°01′37″W, 200 m, 1 June 1994, *E. Gutierrez, R. Quevedo & F. Mamani 1345* (holotype, USZ; isotypes, MO, VDB). Figure 2.

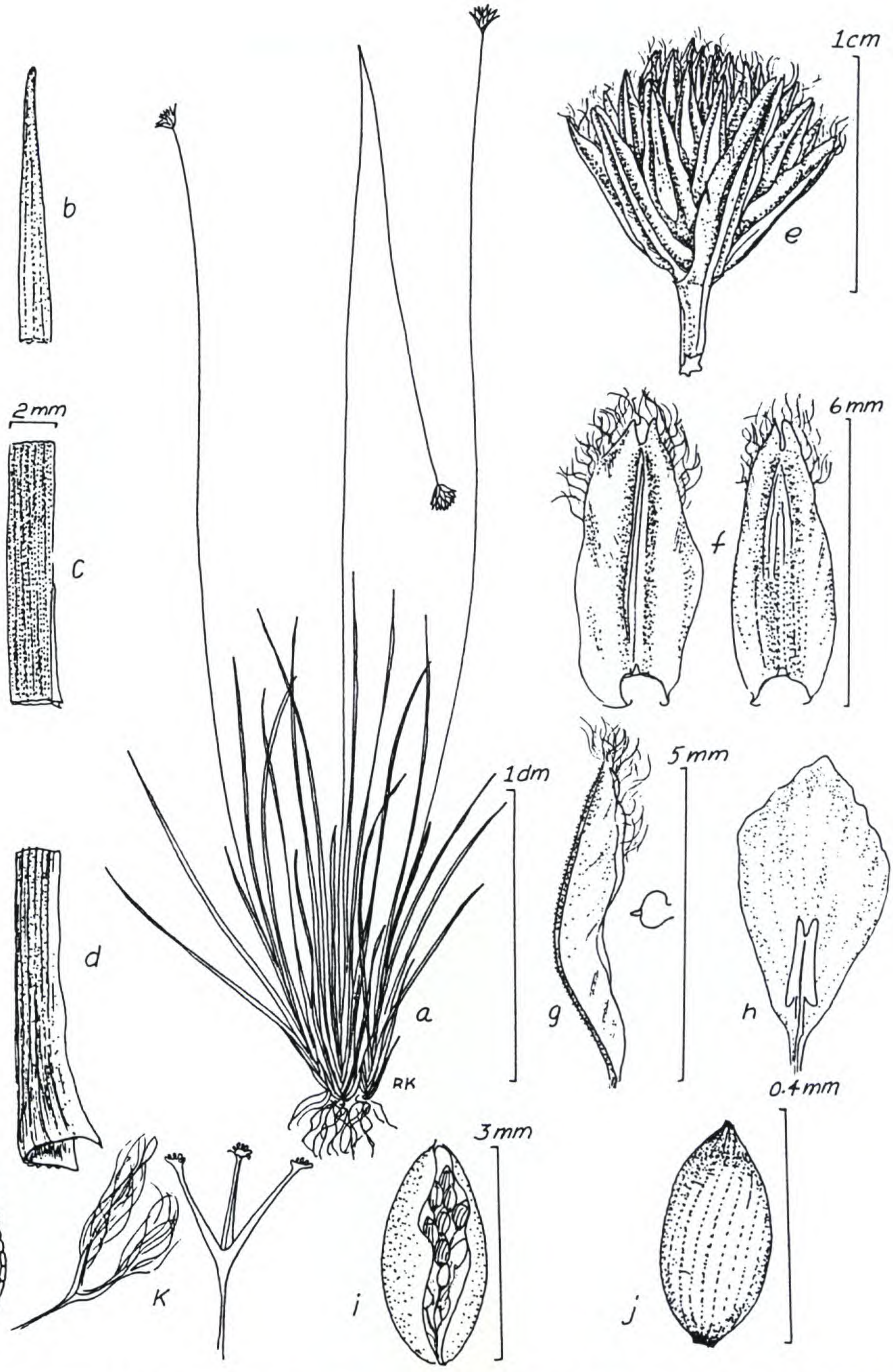


Figure 1. *Xyris amorimii* Kral (*Amorim et al. 1048*). —a. Habit sketch. —b. Leaf apex. —c. Leaf blade, midsector. —d. Leaf base. —e. Spike. —f. Sterile bract (left); fertile bract (right). —g. Lateral sepal. —h. Petal, stamen. —i. Capsule. —j. Seed. —k. Staminodial beard hair, enlarged (left); staminode (middle); stylar apex (right).

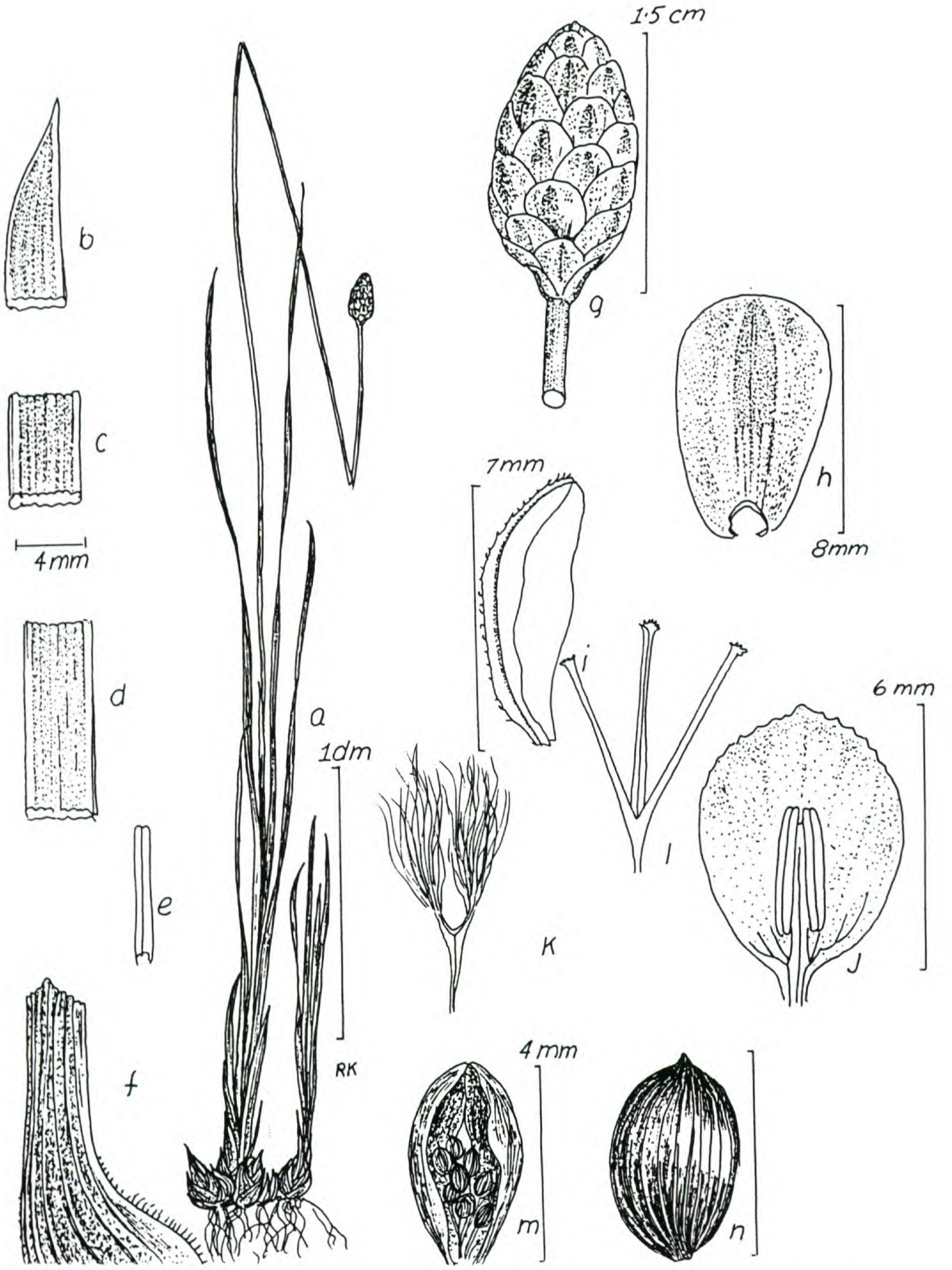


Figure 2. *Xyris boliviana* Kral (*Gutierrez et al. 1345*). —a. Habit sketch. —b. Leaf apex. —c. Leaf blade, midsector. —d. Leaf blade-sheath junction. —e. Leaf blade edge, abaxial side. —f. Leaf base. —g. Spike. —h. Fertile bract. —i. Lateral sepal. —j. Petal blade, stamen. —k. Staminode. —l. Stylar apex. —m. Capsule. —n. Seed.

Fortasse *X. nilssonii* Malme affinis sed valde rhizomatosis, plus robustis, basibus plus atratioribus, vaginis soliorum cilatis, spicis grandioribus, bracteis fertilibus integris, sepalis lateralibus valde inaequilateralis, obtusioribus.

Robust perennial herbs 7–10 dm tall, strongly rhizomatous and bulbous-based, the bulbs ovoid, thick-scaled, at ends of short, scaly, ascending or horizontal rhizomes. Principal leaves stiff, subdistichous (the lower ones transitional to bulb scales and mostly sheath), erect to slightly ascending, twisted, 30–50 cm long, longer than the scape sheaths; sheaths (and bulb scales) ecarinate, scabridulous, ciliate or ciliolate at dilated base, sordidly purple-brown, multicostate, abruptly dilated below, then gradually narrowed into blade, eligulate; blades compressed, linear, slightly twisted, 3–4 times longer than sheaths, longitudinally distinctly few-nerved, the tips asymmetrically subulate; margins thickened, entire, commonly with median sulcus. Scape sheaths firm, twisted, shorter than leaves. Scapes straight or flexuous, twisted, terete toward apex, ca. 1 mm thick, finely striate. Spikes broadly to narrowly ovoid, 1.2–2 mm long, short-attenuate, blunt or obtuse, several-flowered, the sterile bracts several, the lowermost pair oblong-lanceolate, ca. 5 mm long, blunt with linear dorsal areas, the inner ones broader, gradually longer, grading evenly into the fertile; fertile bracts broadly obovate, 8–8.5 mm long, ecarinate, broadly convex, broadly rounded, entire becoming erose, the dorsal areas elliptic, greenish brown, with indistinct median costae. Lateral sepals free, strongly inequilateral, broadly spathulate, 7–7.5 mm long; carinal keel broad, irregularly ciliolate. Petal blades broadly obovate to suborbicular, 6 mm long, yellow, dentate. Staminodia bibrachiate, the branches densely long-penicillate. Anthers curved-oblong, 2–2.5 mm long, emarginate and deeply sagittate, the filaments stout, ca. 0.5–1 mm long. Capsule obovoid, ca. 3.5–4 mm long, the placentation basal. Seeds numerous on long funicles, broadly ellipsoid, apiculate, 0.4–0.5 mm long, shiny, deep brown, longitudinally distinctly multicostate.

Distribution. Thus far known only from wet savanna at low elevation (200 m), Santa Cruz Province, Bolivia.

In existing treatments for *Xyris* of South America this species appears to stand apart, perhaps the nearest to it being *X. nilssonii* Malme, a species that extends from the western planalto of Brazil westward into Bolivia. However, that species, while bulbous-based, definitely lacks the stout scaly rhizomes that connect the larger, more nerved, bulbs of *X. boliviana*. *Xyris boliviana* is more robust, darker-based. Its leaves in venation and margin are similar, but the sheath bases are ciliate rather than entire, lacking the lustrous dark brown borders of *X. nilssonii*. The spikes of *X. boliviana* are similar in being attenuate-based, but are larger with more and broader fertile bracts, which are entire (rather than scarious-lacerate) and with less distinct narrower dorsal areas. The broadly spathulate lateral sepals are very inequilateral, rather than equilateral, are blunt rather than acute, and the seeds are slightly shorter, darker, more lustrous, and broader.

In habit *Xyris boliviana* has some resemblance to *X. asperula* Martius, but that species is in an entirely different complex, since it has no dorsal areas, lacks attenuate spike base, and has longer lateral sepals.

Since we have few records of xyrids from this particular part of Bolivia, and since the plant has been collected now from two different localities within the Parque Nacional, it is quite likely that further records of it will become available as the region becomes better known botanically.

Paratype. BOLIVIA. **Santa Cruz:** Velasco Parque Nacional Noel Kempff M., pampa inundada, 13°33′3″S, 61°03′31″W, 200 m, 30 May 1994, *E. Gutierrez, R. Quevedo & F. Mamani 1285* (MO, Museo Noel Kempff Mercado, VDB).

3. Xyris ferreirae Kral, sp. nov. TYPE: Brazil. Amazonas: Mun. Humaita, BR 230, Rod. Transamazonica a 94 km de Humaita, Reserva Indigena dos Tenharim, 6°55′S, 62°15′W, campina aberta, solo arenoso branco, 15 Abr. 1985, *C. A. Cid Ferreira 5466* (holotype, INPA; isotypes, NY, VDB). Figure 3.

Habitu, folia, et apicis bracteorum *X. hymenachne* Martius similis, sed vaginis foliorum ciliatis, plus atratioris, laminis foliorum submarginale incrassatis, dense rufociliolatis.

Perennial, caespitose, 3–8 dm long, the stems short, the bases thickened, the roots slender-fibrous. Principal leaves narrowly linear, 15–25 cm long, distichous, in narrow fans, longer than the scape sheaths; blades level to slightly twisted, 2–3 mm broad, flattened, multinerved, smooth, red-brown, submarginally with a strong, raised band, the apex abruptly asymmetrically narrowed to a short-subulate tip, the margin thin, rusty, densely ciliolate; leaf sheaths dilated, carinate, multicostate and ciliate at base, abruptly then gradually narrowed upward to converge with blade, there eligulate. Scapes slender, erect, slightly twisted, flexuous, subterete, longitudinally with several low ribs, with 1 strong rusty-ciliolate costa (rarely another). Spikes broadly ellipsoid, 6–9 mm long, several-

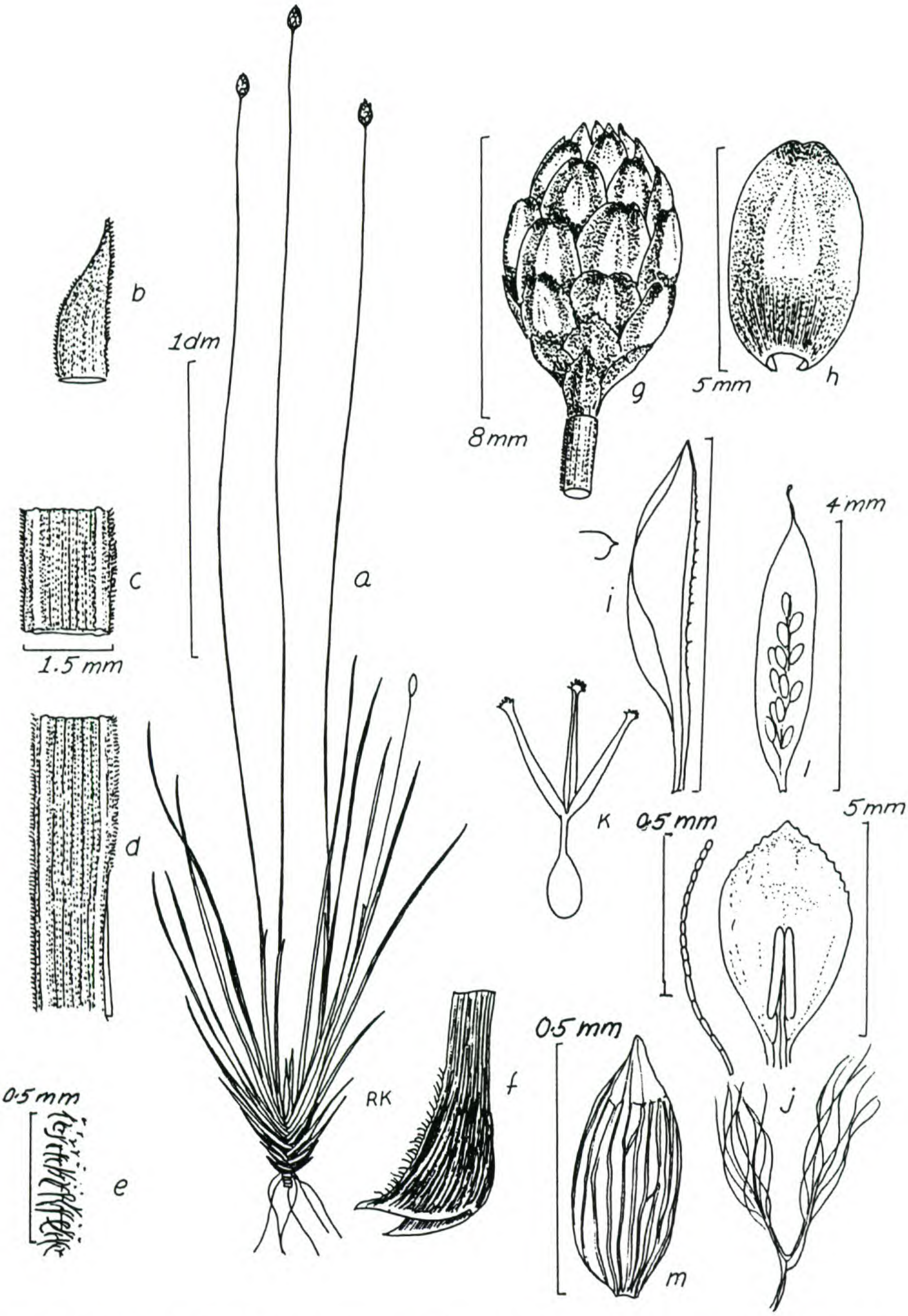


Figure 3. *Xyris ferreirae* Kral (*Cid Ferreira 5466*). —a. Habit sketch. —b. Leaf apex. —c. Leaf blade, midsector. —d. Leaf blade-sheath junction. —e. Leaf blade edge, magnified. —f. Leaf base. —g. Spike. —h. Fertile bract. —i. Lateral sepal. —j. Staminodial beard hair, enlarged (left); petal blade, stamen (right); staminode (below). —k. Stylar apex. —l. Capsule outline, showing placentation. —m. Seed.

bracted, the bracts spirally imbricate, convex, ecarinate, pale brown with darker tip and base, with scarious, paler, entire borders, aging lacerate; sterile bracts several, ovate, subcarinate, 1.5–4.5 mm long with narrowly elliptic dorsal areas; fertile bracts obovate to broadly elliptic, ca. 5 mm long, obtuse or shallowly emarginate, the inner ones oblong; dorsal areas elliptic or narrowly ovate, venulose. Lateral sepals free, inequilateral, narrowly elliptic, ca. 5 mm long, acute; keel narrow, firm, straight, sparsely and remotely ciliolate. Petal blades elliptic, ca. 5 mm long, yellow, apically serrulate. Anthers lance-oblong, ca. 1.5 mm long, emarginate and deeply sagittate, on flattened, shorter filaments. Capsules cylindric, ca. 4 mm long; placentation central. Seeds narrowly ovoid, 0.5 mm long, with pale-conic apiculus, brownish, translucent, irregularly several-costate longitudinally.

Distribution. Thus far known only from white sand savanna and adjacent gallery woodland, municipalites of Humaita and Manicore, Amazonas, Brazil.

In leaf and general habit this novelty bears some resemblance to the widespread savanna species *Xyris hymenachne* Martius, resembling it also somewhat in the pale, friable bract borders. However, this plant has distinct dorsal areas, its dark leaf sheath bases are ciliate, and its leaf blades are submarginally thickened, bordered by a narrow, rusty and rusty-ciliolate edge, all features that compel one to place the species elsewhere in the genus.

Paratype. BRAZIL. **Amazonas:** Mun. de Manicore, BR 230, 150 km ao L de Humaita e 18 km ao S pela Rod. do Estanho, 8°10′S, 61°45′W, Mata de beira de astrada, solo arg., 15 Abr. 1985, *C. A. Cid Ferreira 5506* (INPA, NY, VDB!).

4. Xyris gongylospica Kral, sp. nov. TYPE: Venezuela. Bolívar: Mun. Gran Sabana, Sierra de Lema, SE headwaters of Rio Carrao, 1050 m, 5°54′N, 61°42′W, seeps along stream in riparian scrub, 22 Jan. 1993, *R. Kral 81888* with *O. Huber & Anna Weitzmann* (holotype, VEN; isotypes, GH, K, MO, MYF, NY, SMU, US, VDB). Figure 4.

X. thysanolepis Maguire & Lyman B. Smith primo adspectu maxime simile, sed paginis foliorum et scaporum omnino scabridulis aut rugulosis, scapis teretibus et grosse multicostatis, spicis latioribus, attenuatis, sepalis lateralis valde inaequilateris, obtusioribus.

Caespitose perennial 5–7 dm high, the roots slender, fibrous, the stems short or up to 5 cm long. Principal leaves in fans, 15–30 cm long, longer than the scape sheaths; sheaths carinate, long-ciliate, thin, papillose to rugulose, pale red or tan, dilated at base, gradually narrowing upward to blades, eligulate; blades 3–4 times shorter than sheaths, narrowly linear-gladiate, plane, 3–6 mm wide, dull green, transversely undulately tuberculate-rugose; apices gradually, then abruptly narrowed, incurved-acute, slightly thickened; margins thin, densely and coarsely brown-ciliate. Scape sheaths red-brown toward base, angulate, multicostate, distally open, carinate, short-bladed. Scape apically terete, ca. 1–1.2 mm thick, coarsely multicostate, densely scaberulous to papillose, dull green. Spikes multiflorous, subglobose, ca. 1 cm long, attenuate; bracts erect, loosely spirally imbricate, thin, convex, ecarinate, without dorsal area, deep red-brown, broadly rounded with narrow, scarious, pale, erose borders; sterile bracts several, obovate, the lower pair obovate, ca. 3 mm long; fertile bracts broadly obovate, ca. 5 mm long. Lateral sepals free to slightly connate, strongly inequilateral, spathulate, ca. 5 mm long, obtuse, slightly curved, the keel wide, from base to tip irregularly brownish ciliate. Petal blades obovate, 4.5–5 mm long, yellow, broadly acute, undulate. Staminodia bibrachiate, the branches densely long-penicillate. Anthers oblong, ca. 2 mm long, deeply emarginate and sagittate; filaments ca. 1 mm long. Capsules narrowly obovoid, 3 mm long; placentation central. Seeds numerous, cylindric-ellipsoid, ca. 1 mm long, longitudinally spirally multiribbed, translucent.

Distribution. Thus far known only from the type locality.

In the most recent published treatment of *Xyris* for the area (Kral, 1988) this would belong to the complex containing *X. thysanolepis* Maguire & Lyman B. Smith, for which we now have several localities within the Guayana Highlands. However, this differs from such plants by having completely scabridulous and rugulose leaf and scape surfaces, by its terete and coarsely multicostate scapes, and by its mostly broader spike outline. Also, it differs in the spike base, which is attenuate and made up of many more sterile bracts, as well as in its lateral sepals, which are strongly inequilateral and blunter.

Grateful acknowledgment is here given to the División de Cuencas e Hidrológica de CVG, Electrificación del Caroni, C.A. (EDELCA) for logistic support, and to the Instituto Nacional de Parques (INPARQUES) for its permission to visit localities within the Parque Nacional Canaima. Thanks are also very much due Anna Weitzmann and Otto Huber for genuine botanical companionship on and

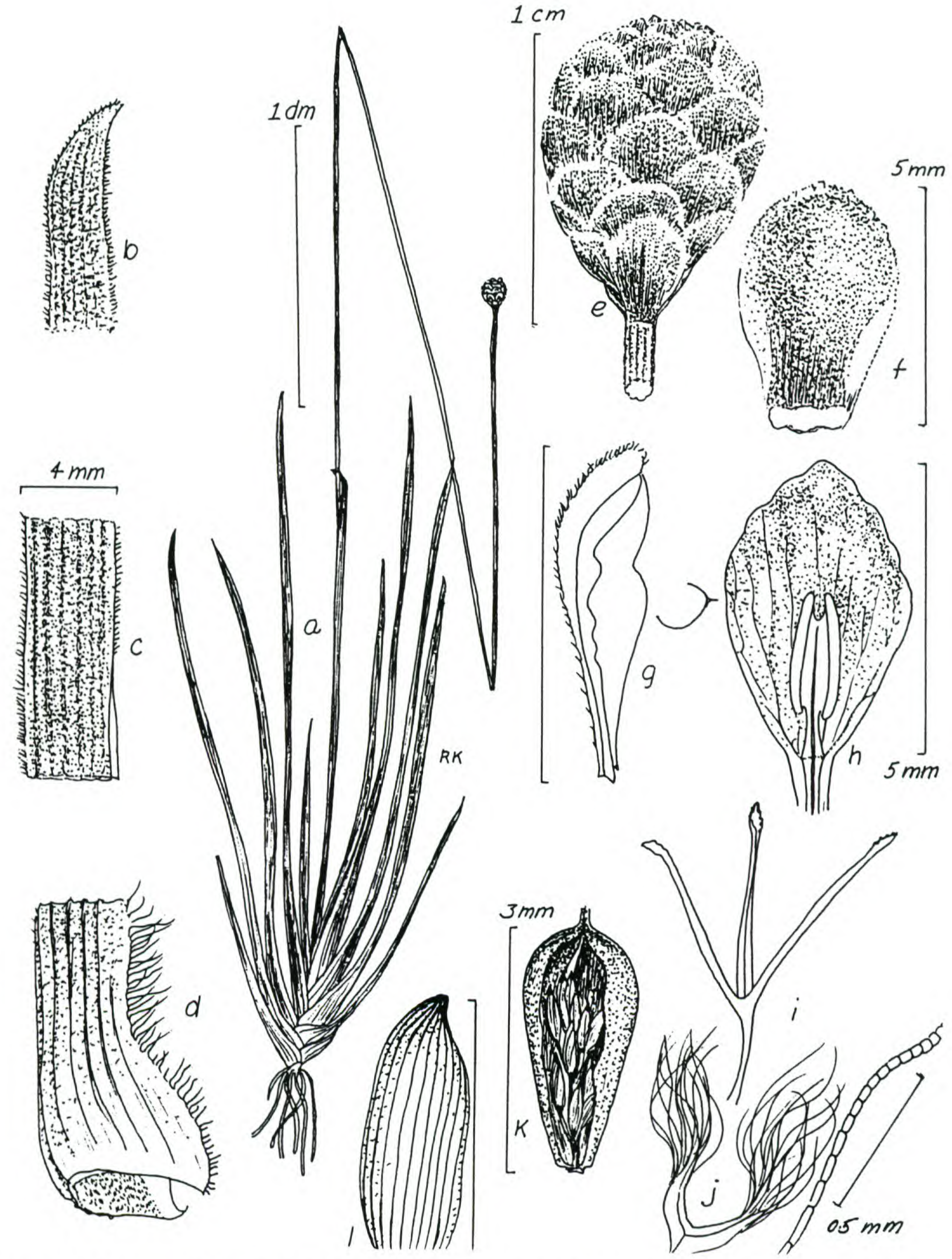


Figure 4. *Xyris gongylospica* Kral (*Kral et al. 81888*). —a. Habit sketch. —b. Leaf apex. —c. Leaf blade-sheath junction. —d. Leaf base. —e. Spike. —f. Fertile bract. —g. Lateral sepal. —h. Petal blade, stamen. —i. Stylar apex. —j. Staminode (left); beard hair, enlarged. —k. Capsule. —l. Seed.

below the tepuis, and to the latter for his willingness to show us the country.

5. Xyris guillenii Kral, sp. nov. TYPE: Bolivia. Velasco: Parque Nacional Noel Kempff M., pampa grande de Bella Vista, pampa termiteria anegado temporalmente, suelos franco arcillosos, 13°42′10″S, 61°31′1″W, 180 m, *R. Guillen et al. 3904* (holotype, USZ; isotypes, MO, VDB). Figure 5.

X. lacerata Pohl ex Seubert valde similis, sed circumferentiis spicarum latioribus, sepalis lateralis valde inaequilateris, spathulatis.

Plants perennial, short-stemmed, bulbous-based, with slender roots. Outer (lower) leaves scale-like, contracted, broadly ovate, 0.5–2 cm long, subulate-acuminate, strongly costate, papillate. Principal leaves suberect, 10–23 cm long, strongly flexuous and twisted, longer than the scape sheaths; blades at base a little involute, 2–2.5 mm wide, upward convolute, then conduplicate, subterete, ca. 1 mm thick, shallowly multicostate, at tip triquetrous-subulate; sheath toward base rounded, longitudinally costate, pale brown, undulate-rugulose, long-ciliate, upward abruptly then gradually converging to blades, eligulate. Scape sheaths twisted, open at apex, short-bladed. Scapes linear, erect, strongly twisted and flexuous, terete, with many low costae, ca. 1.5 mm thick, punctate, smooth. Spikes broadly obovoid to broadly ellipsoid, hemispheric or subglobose, attenuate-based, 1–1.5 cm long, multibracteate, the lower (sterile) bracts many, orbiculate to broadly ovate or reniform, 2–5 mm long, shorter than the fertile and grading into them, with broadly triangulate dorsal areas. Fertile bracts broadly obovate, becoming (upspike) oblong, 6–7 mm long, with elliptic to oblong dorsal areas. Lateral sepals free, strongly inequilateral, spathulate, 5–6 mm long, with elliptic to oblong dorsal areas. Lateral sepals free, strongly inequilateral, spathulate, 5–6 mm long, obtuse, strongly incurved, ciliolate. Petal blades elliptic, ca. 5 mm long, yellow. Staminodia bibrachiate, branches elongate, long-penicillate. Anthers lanceolate, ca. 2 mm long, tetralocular, deeply sagittate and retuse, the filaments flattened, shorter. Capsule cylindric-ellipsoid, ca. 4.5 mm long, placentation central. Seeds cylindro-ellipsoid to ellipsoid, 0.5–0.6 mm long, bi-apiculate, translucent, reddish brown, strongly 12–14-costate, transversely striolate.

This novelty, named after its collector and known only from the type, bears strong resemblances to *Xyris lacerata* Pohl ex Seubert, perhaps sufficient to be considered conspecific. Differences mostly have to do with sepal character (in *X. guillenii* the sepals are very inequilateral and spathulate, while in *X. lacerata* they are but slightly so and are elliptic-oblong), and spike size and shape. In fact, the latter features are what draw one's attention first. My own material, consisting of two plants and five spikes, shows a suprising range, with two of the five being double (as in *X. bicephala*), this feature not included in the above description on the distinct possibility of it being anomalous. The other three spikes show a range from hemisphaeroid to subglobose. At the least, however, these plants make an example that would stand out in the field in contrast to nearby *X. lacerata.*

6. Xyris subasperula Kral, sp. nov. TYPE: Bolivia. Velasco: Parque Nac. Noel Kempff M., Campamento "Laja," sobre senda de Geobol, a 15 km al SE de Los Fierros sobre rocas areniscas, en medio de campo humedo, 14°33′S, 60°45′W, 750 m, 21 July 1995, *T. J. Killeen, J. Blalce & C. Graham 7480* (holotype, USZ; isotypes, MO, VDB). Figure 6.

Habitu, indumentis foliorum et scaporum, et basi plantarum, *X. asperula* Martius valde affinis sed spicis attenuatis, bracteis sterilibus multo numerosis, multo parvis, gradatis, seminibus multo numerosis, distincte brevioribus.

Plants perennial, 6–10 dm high, solitary or caespitose, the bases bulbous, dark brown. Roots slender-fibrous. Stems short. Leaves ensiform-linear, 17–55 cm long, twisted, erect to slightly spreading, longer than the scape sheaths; blades flattened, 3–5 times longer than the sheaths, 2.5–4 mm wide, olivaceous (in the dry specimen), transversely undulate-rugose, longitudinally multinerved, nerves low; apices gradually then abruptly narrowed, tip subulate; margins narrow, densely retrorsely scabrociliate or scabrid; sheaths ecarinate, at base papillose, abruptly dilated, long-ciliate, upward gradually narrowed, transversely undulate-rugose, gradually converging to blade, eligulate. Scape sheaths twisted, low-costate, similar to leaf in color and blade apex. Scapes linear, terete, toward apex 1–1.4 mm thick, shallowly multicostate, scabrid. Spikes many-flowered, ellipsoid to cylindric, 1.5–2.5 cm long, obtuse, short-attenuate, the bracts spirally imbricate, firm, ecarinate, brownish, entire, without distinct dorsal areas; sterile bracts broadly ovate to suborbiculate, 4–5.5 mm long, shorter than the fertile and grading into them; fertile bracts broadly obovate (the inner oblong), 6–8.5 mm long. Lateral sepals free, slightly inequilateral, narrowly elliptic, 7–8.5 mm long; carinal keel antrorsely ciliolate from middle to apex. Petal blades, stamens,

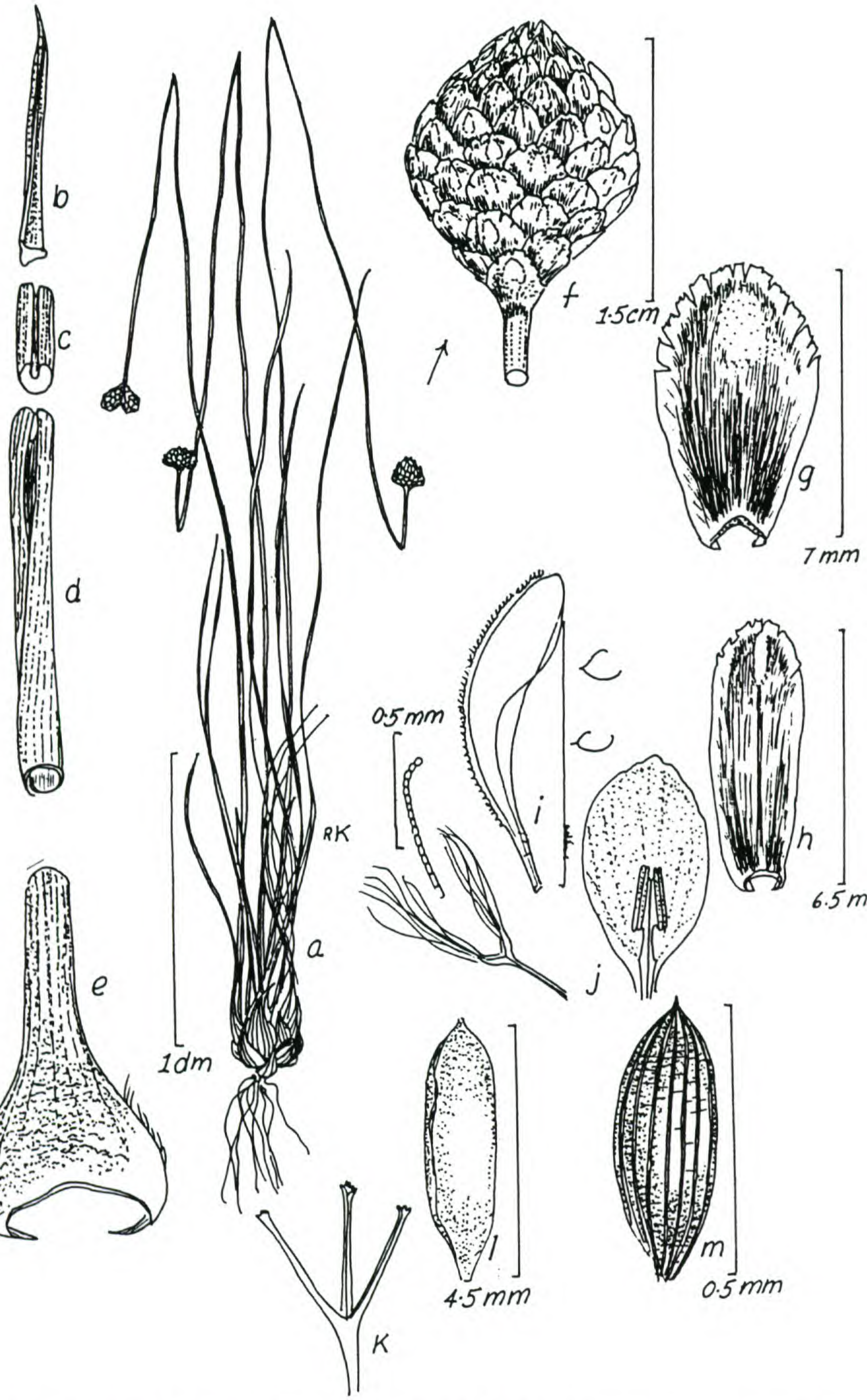


Figure 5. *Xyris guillenii* Kral (*Guillen et al. 3904*). —a. Habit sketch. —b. Leaf apex. —c. Leaf blade sector. —d. Leaf sheath apex. —e. Leaf base. —f. Spike. —g. Fertile bract (from base of spike). —h. Fertile bract (from near spike apex). —i. Lateral sepal. —j. Staminode and enlarged beard hair (left); petal blade, stamen (right). —k. Stylar apex. —l. Capsule. —m. Seed.

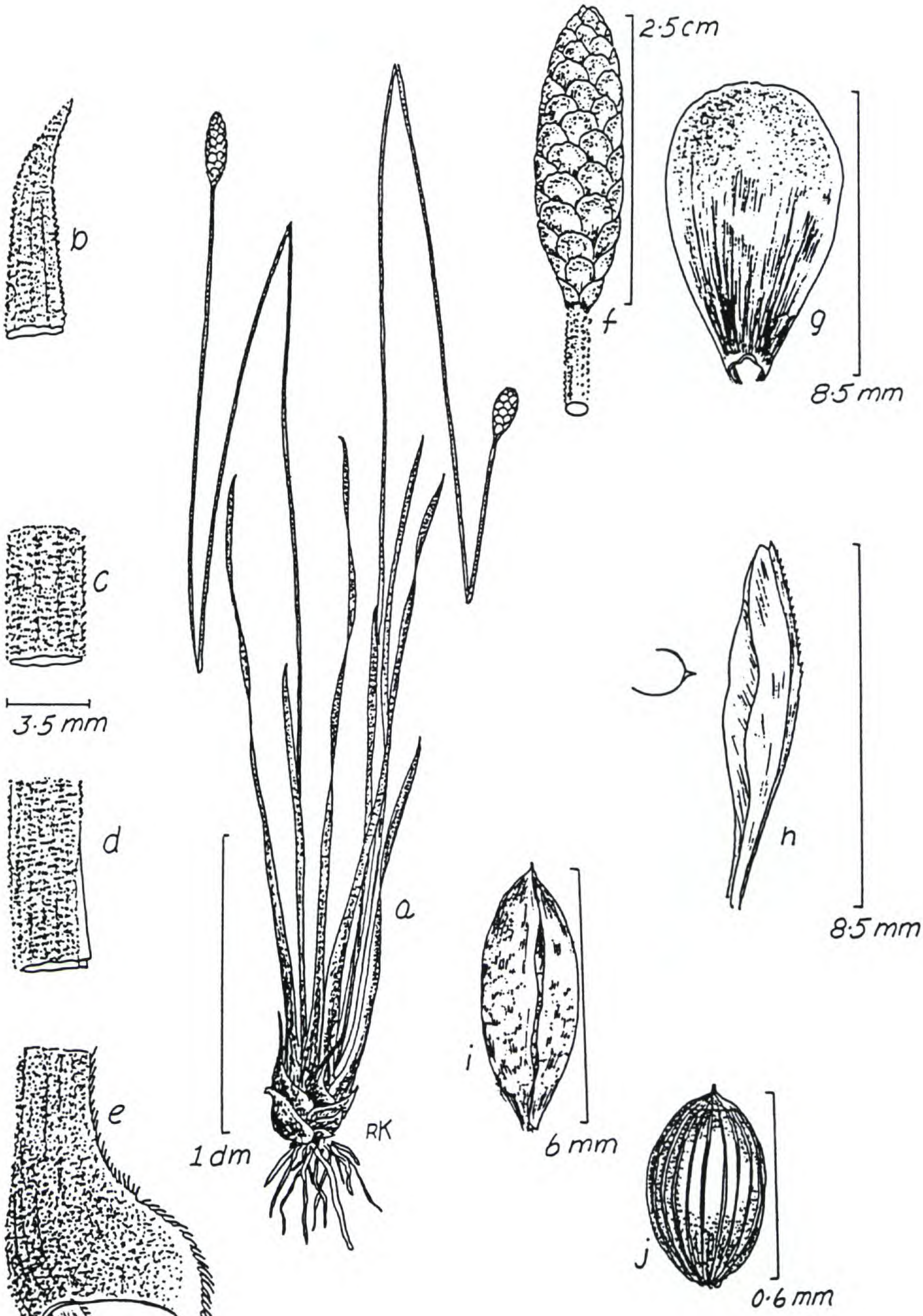


Figure 6. *Xyris subasperula* Kral (*Killeen et al. 7480*). —a. Habit sketch. —b. Leaf apex. —c. Sector of leaf midblade. —d. Leaf sheath-blade junction. —e. Leaf base. —f. Spike. —g. Fertile bract. —h. Lateral sepal. —i. Capsule. —j. Seed.

and staminodia not seen. Capsule narrowly ellipsoid, ca. 6 mm long; placentation free-central. Seeds numerous, broadly ovoid to broadly ellipsoid, 0.45–5 mm long, apiculate, translucent, red-brown, finely longitudinally multiribbed.

This species, in general habit (scabrous to scabridulous leaves and scapes, bulbous base, etc.), bears strong resemblance to the widespread Brazilian *Xyris asperula* Martius, but differs in its attenuate (rather than rounded) spike base, its more numerous, smaller, gradate sterile spike bracts, and its distinctly smaller seeds.

Literature Cited

Kral, R. 1988. The genus *Xyris* (Xyridaceae) in Venezuela and contiguous northern South America. Ann. Missouri Bot. Gard. 75: 522–722.

———. 1994. Xyridaceae. *In:* Flora of the Guianas, Ser. A: Phanerogams, fasc. 15. Koeltz Scientific Books, Königstein, Germany.

Maguire, B. & L. B. Smith. 1964. Xyridaceae. *In:* B. Maguire, J. J. Wurdack & Collaborators, The Botany of the Guayana Highland—Part V. Mem. New York Bot. Gard. 10(5): 7–37.

Smith, L. B. & R. J. Downs. 1968. Xyridaceae. *In:* F. C. Hoehne, Fl. Brasilica 9(2): 1–215.

A New Nematopoid Species of *Xyris* (Xyridaceae) from Guyana[1]

Robert Kral
Herbarium (VDB), Vanderbilt University, Box 1705, Sta. B, Nashville, Tennessee 37235, U.S.A.

Marion Jansen-Jacobs
Herbarium Division, Department of Plant Ecology & Evolutionary Biology, Heidelberglaan 2, 358y, CS Utrecht, The Netherlands

ABSTRACT. A new species of *Xyris* has been found in the wet savanna lands of the Rupununi District, Guyana. *Xyris dilatatiscapa* is described, illustrated, and discussed as to its relationships with other *Xyris*.

Xyris dilatatiscapa Kral & Jansen-Jacobs, sp. nov. TYPE: Guyana. Rupununi District between Dadanawa and Mountainpoint, wet savanna, 100–150 m, 2°55′N, 59°40′W, 3 Oct. 1992, *M. J. Jansen-Jacobs, B. J. H. ter Welle, H. J. M. Sipman & V. James 2734* (holotype, U; isotypes, BRG, VDB). Figure 1.

Xyris paraensis Poeppig ex Kunth et *X. savanensis* Miquel aliquot similis, vaginis foliorum ciliatis, scapis supra medio aut apicem versus abrupte dilatatis et papillosis, sepalis lateralibus integris, laminis staminodiorum imberbibus, obcordatis, tumidis, differt.

Plant low, slender, solitary to caespitose, annual or perennial (4–)6–10(–14) cm high, stems contracted. Roots slender. Principal foliage leaves erect to spreading, (1.5–)2–3 cm long, somewhat twisted, longer than scape sheaths to slightly shorter; blades narrowly linear, ca. 0.5 mm wide, fleshy, slightly compressed, involute, green, obtuse, lunate in cross section, transversely undulate-rugose, margin and midzone abaxially deep green, thickened, with pale green intervals; sheaths pale green, few-costate, costae green, papillose, gradually narrowing to blades, gradually dilating proximally, borders scarious, long-ciliate. Scape sheaths lax, mostly open, twisted, rugulose, short-bladed, obtuse. Scapes filiform, subterete, pale red-brown, ca. 0.2 mm thick, abruptly dilating above the middle to ca. 0.5 mm, dark green, longitudinally costate, transversely rugose-scabridulous or rugulose-papillate (as in leaf blades). Spikes ellipsoid, 4–5 mm long, few-flowered, fertile bracts loosely spirally imbricate, convex, thin, with scarious, entire, pale brown borders, obovate or broadly elliptic, 3.5–4 mm long, broadly acute, with narrowly ovate to triangular dorsal areas; sterile bracts mostly 4, subdecussate, ovate, 1.5–1.7 mm long, slightly shorter than the fertile ones, with dorsal areas narrowly lanceolate, green. Lateral sepals free, inequilateral, elliptic, 3–3.5 mm long, acute, curved; carinal keel firm, narrow, entire. Petal blades elliptic, ca. 3 mm long, yellow, apically low-serrate. Anthers broadly oblong, ca. 0.5 mm long, deeply bifid and sagittate; filaments thickened, ca. 0.5 mm long. Staminodial blades obcordate, ca. 1 mm long, tumid, beardless. Capsule ellipsoid, ca. 2.5 mm long, placentation central, placenta trifid apically. Seeds numerous, cylindro-ellipsoid, 0.6–0.7 mm long, pale red-brown, longitudinally finely lined, translucent.

Distribution. Known only from the type locality.

Application of prior treatments of *Xyris* such as those by Idrobo (1954), Maguire and Smith (1964), Smith and Downs (1968), and Kral (1988, 1994) provide no sure lead to a close relative of this new taxon. There are, as the description shows, superficial resemblances to *X. paraensis* Poeppig ex Kunth and *X. savanensis* Miquel. However, the sheath edges of *X. dilatatiscapa* are ciliate, rather than entire as in those species; its leaf blades are distinctly thickened with incrassate-papillate, involute edges, unlike those species; its scapes are abruptly dilated above midscape, there also densely papillose in contrast to the more slender, glabrous lower scape (this feature is, so far as we know, a distinction held by no other *Xyris*); its lateral sepals have entire keels in contrast to the more strongly curved, ciliate keels of *X. savanensis* and *X. paraensis*; its staminodial blades are bifid and beardless as is true for *X. savanensis*, but are obcordate and tumid (rather than deeply cleft and flattened). Distinctive also is the placental situation, which in

[1] Studies on the flora of the Guianas 86.

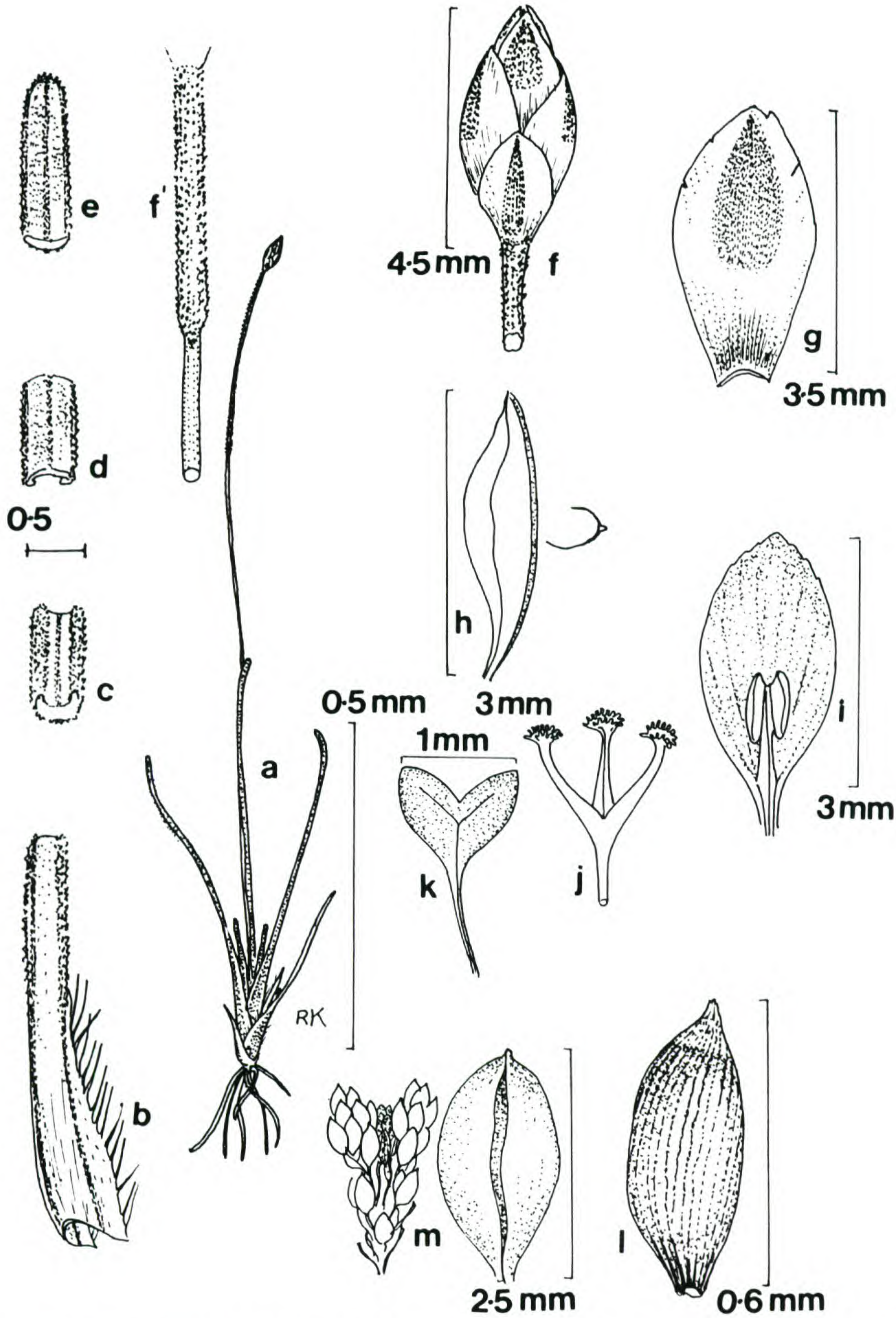


Figure 1. *Xyris dilatatiscapa* Kral & Jansen-Jacobs (from *Jansen-Jacobs et al. 2734*). —a. Habit sketch. —b. Leaf base. —c. Leaf blade sector, adaxial. —d. Leaf blade sector, abaxial. —e. Leaf apex, adaxial (left). f¹. Scape apex. —f. Spike. —g. Fertile bract. —h. Lateral sepal. —i. Petal blade, stamen. —j. Stylar apex. —k. Staminodial blade. —l. Seed. —m. Placenta (left); capsule (right).

this new species is central and columellar below the middle, three-branched distally and with the numerous seeds on comparatively short funicles, rather than basal with elongate funicles.

Literature Cited

Idrobo, J. M. 1954. Xyridaceae de Colombia. Caldasia 6(29): 184–260.

Kral, R. 1988. The genus *Xyris* (Xyridaceae) in Venezuela and contiguous northern South America. Ann. Missouri Bot. Gard. 75: 522–722.

———. 1994. Xyridaceae. *In:* Flora of the Guianas, Ser. A: Phanerogams, fasc. 15. Koeltz Scientific Books, Königstein, Germany.

Maguire, B. & L. B. Smith. 1964. Xyridaceae. *In:* B. Maguire, J. J. Wurdack & Collaborators, The Botany of the Guayana Highland—Part V. Mem. New York Bot. Gard. 10(5): 7–37.

Smith, L. B. & R. J. Downs. 1968. Xyridaceae. *In:* F. C. Hoehne, Fl. Brasilica 9(2): 1–215.

Antidaphne hondurense Kuijt, a Second Mesoamerican Species of Eremolepidaceae

Job Kuijt

Department of Biology, University of Victoria, Victoria, B.C. V8W 3N5, Canada

ABSTRACT. The second continental species of *Antidaphne* north of Colombia, *A. hondurense* Kuijt (Eremolepidaceae), is described and illustrated. The species is monoecious and related to *A. andina* Kuijt and *A. wrightii* (Grisebach) Kuijt.

Antidaphne hondurense Kuijt, sp. nov. TYPE: Honduras. Comayagua: (San Juanillo), Camino a San Juanillo, 11 km al Suroeste de Siguatepeque, Reserva Biológica Cordillera de Montecillos, bosque nublado latifoliado, 14°29′N, 87°53′W, 1890 m, sobre *Quercus* (No. 218), *Mejía Darío 219* (holotype, MO; isotype, LEA). Figures 1–6.

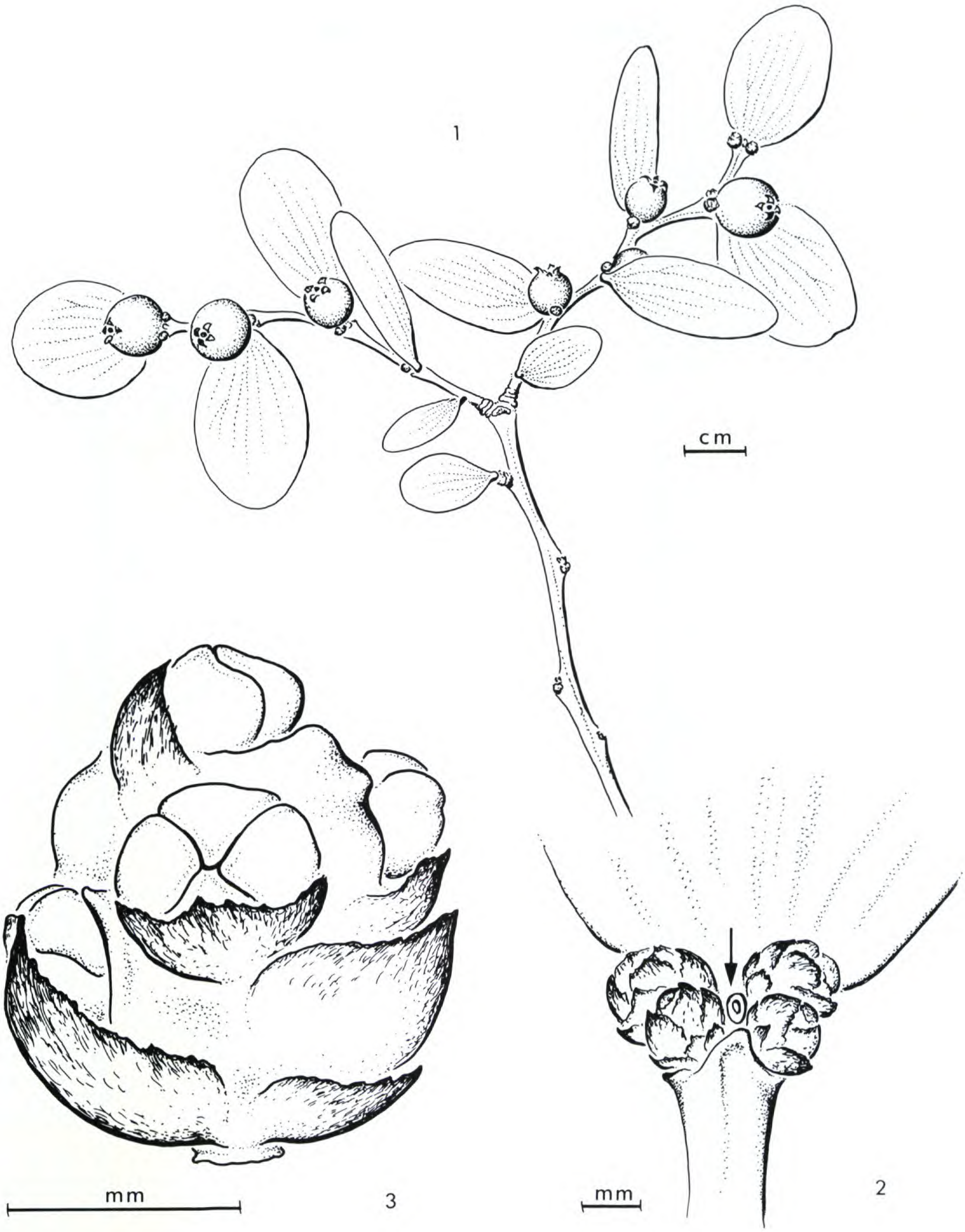
Folia elliptica vel ovata, sessiles, apice obtusa. Flores distributione monoica, floribus pistillatis singulis, staminatisque in spicis brevissimi.

Inconspicuous, glabrous plants 0.5 m diam., sympodial in habit, branches forking regularly, internodes strongly angular when young, ca. 1 cm long. Leaves to 3 × 2 cm, elliptical to ovate, sessile, fairly thin but leathery, apex rounded, base obtuse to acute, attachment 2 mm wide, from which numerous palmate veins reach far into the blade. Monoecious; flower buds 1 × 1 mm, globular; petals 4, triangular. Male inflorescences apparently originating in the axils of the prophylls associated with the female flower and thus paired, and developing later than the female flower; male flowers with 4 free stamens 0.5 mm long opposite petals and surrounding a central disk, anthers with 4 locules, flowers in a very short (3 mm), squamate, indeterminate spike, 6 per spike, each sunken in small alveolus above a scale-leaf. Female flower in cupulate bract, which is placed between two somewhat naviculate prophylls with lacerate margin and acute tip, the combined structure axillary to, and solitary in the axil of, a foliage leaf; style 0.5 mm long, stout and straight, with flat stigmatic surface. Fruit ca. 8 mm diam., spherical or nearly so, smooth, purple, the small, persistent petals recurved.

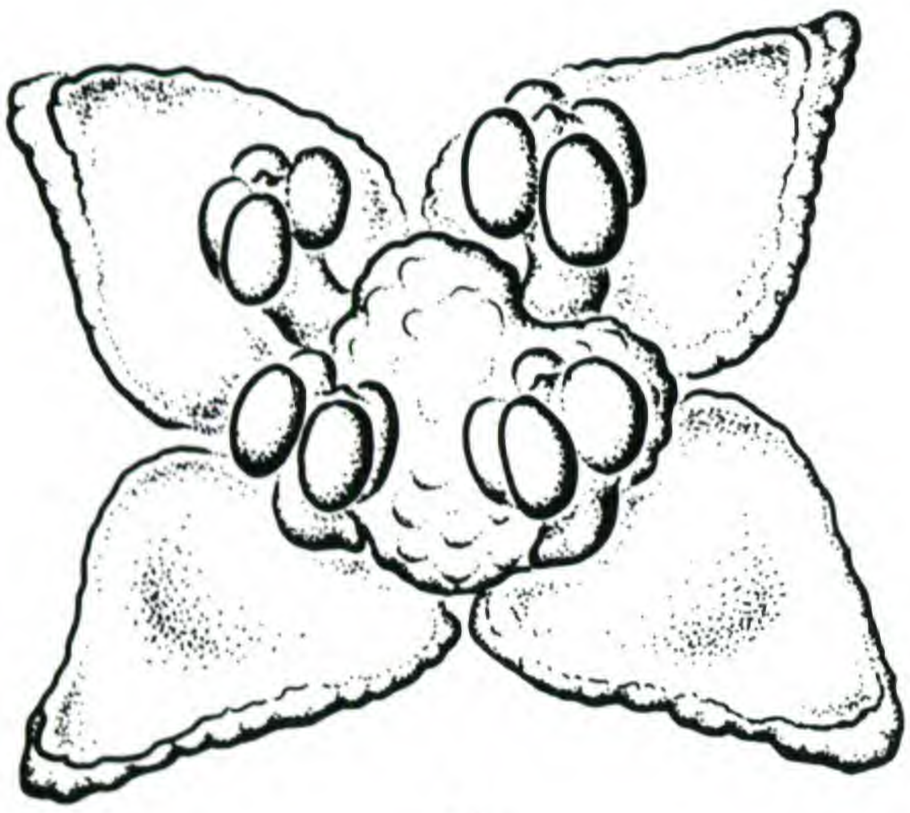
Antidaphne hondurense represents the second continental species of Eremolepidaceae north of Colombia, the other species, *A. viscoidea* Poeppig & Endlicher, ranging from Chiapas to Bolivia (Kuijt, 1988). The latter has not, however, so far been collected in Honduras. In fact, *A. hondurense* is more closely related to *A. andina* Kuijt from the northern Andes, and possibly to *A. wrightii* (Grisebach) Kuijt from the Greater Antilles, and forms an interesting geographical connection between the two. All three species, in contrast to *A. viscoidea*, are monoecious, the former two with one female and several male flowers occupying each leaf axil, at least the female flowers not associated in inflorescences; furthermore, female flowers are 4-partite rather than 2- or 3-partite, as in *A. viscoidea;* and male flowers bear petals in species other than *A. viscoidea*, which is apetalous. *Antidaphne hondurense* differs from *A. andina* and *A. wrightii* in its sympodial habit, leaf shape, and in the much larger, more spherical, and purple fruit. I am assuming that at least the young plants have basal roots, as they do in the other species of *Antidaphne*.

The plant is sympodial—a condition that has frequently evolved in various mistletoe genera, including *Eubrachion* of Eremolepidaceae (Kuijt, 1988)—but the particular form which this branching pattern takes in *A. hondurense* seems to be unique at least among mistletoes. As mentioned in the above description, each leaf is normally associated with one female flower, placed in a median position, plus two collateral buds; the latter, in turn, may be flanked by one or two smaller buds. However, the largest pair of collateral buds of the uppermost leaf develop into two more or less symmetrical innovations. Thus a more or less regularly forked plant develops, even though the alternate phyllotaxy of the species would seem to prohibit it.

Paratype. HONDURAS. **Comayagua**: Cerro Azul Meámbar, 10.5 km E of lago Yojoa, dense hardwood cloud forest with bamboo understory on ridge leading to Cerro Azul peak, 14°18′N, 87°53′W, 1850 m, *Thomas 617* (MO).

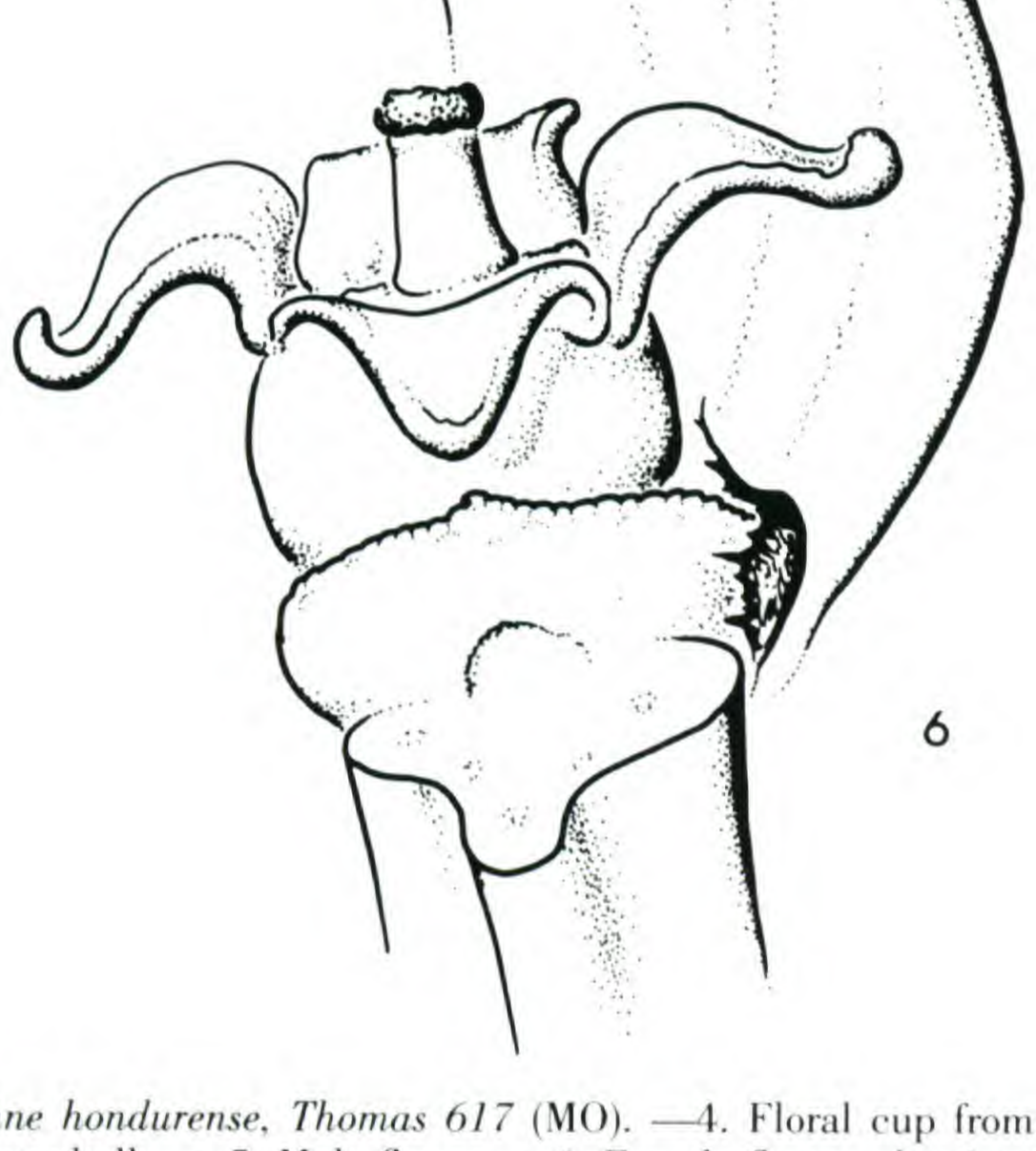


Figures 1, 2. *Antidaphne hondurense* Kuijt, *Mejia Dario 219* (LEA). Figure 3, same, *Thomas 617* (MO). —1. Habit of fruit-bearing plant. —2. Tip of branch showing lateral placement of young male inflorescences (or vegetative shoots) flanking central scar (arrow) probably representing a fruit. —3. Mature male inflorescence just prior to anthesis.



5

4



6

mm

Figures 4–6. *Antidaphne hondurense, Thomas 617* (MO). —4. Floral cup from which fruit has been removed, subtended by two lacerate prophylls. —5. Male flower. —6. Female flower, showing floral cup and one of the two lacerate prophylls.

Acknowledgment. The continuing support of the Natural Sciences and Engineering Research Council of Canada is acknowledged.

Literature Cited

Kuijt, J. 1988. Monograph of the Eremolepidaceae. Syst. Bot. Monogr. 18: 1–60.

Disa virginalis (Diseae: Orchidoideae: Orchidaceae): A New Species from Southern Africa

H. Peter Linder and Steve D. Johnson
Bolus Herbarium, Department of Botany, University of Cape Town, Rondebosch 7700, South Africa

William R. Liltved
Compton Herbarium, National Botanical Institute, Claremont 7735, South Africa

ABSTRACT. A new species of *Disa*, the largest genus of terrestrial orchids in southern Africa, is described from the Western Cape. *Disa virginalis*, sp. nov., was previously included in *D. maculata*, but is white rather than blue, with shorter and broader lateral sepals, and a less developed spur. In addition, the galea is narrowed in front. Similarities to *D. schizodioides* are also discussed; these indicate that the current sectional classification of subgenus *Disa* may not be correct.

Disa P. J. Bergius, with ca. 130 species, is the largest genus in the subtribe Disinae. The three other genera in the subtribe, *Monadenia* Lindley, *Herschelianthe* Rauschert, and *Schizodium* Lindley, each has less than 20 species. *Disa* is widespread in the cooler parts of Africa. The majority of the species are found in the mountains and on the coastal flats of the southwestern tip of South Africa, and the genus is also common in the montane grasslands from the Drakensberg northward to Ethiopia and westward to Liberia. A single species is found in Yemen (Linder, 1983). The generic delimitation of the genus remains contentious, and it is possible that the satellite genera *Herschelianthe* and *Monadenia* should be included within *Disa* (Linder & Kurzweil, 1994). Although Linder (1981) published a detailed subgeneric classification for *Disa*, many of the sections and subgenera may not be monophyletic, and so need further evaluation (Linder, 1986; Linder & Kurzweil, 1990).

With the increasing interest in the relationship between pollinators and floral morphology, much research has been done on the Disas (Johnson, 1994, 1995a, 1995b, 1995c; Johnson & Linder, 1995), and this interest has led to the discovery of several new species, one of which is described here.

Disa virginalis H. P. Linder, sp. nov. TYPE: South Africa. Western Cape: Groot Winterhoek Forest Reserve, on dry rock ledges, *Linder 6598* (holotype, BOL). Figure 1.

A *Disa maculata* L.f. floribus parvis albis et petalis brevibus latis, a *D. schizodioides* Sonder lobis basalibus petalorum expansis et labiis aequantibus sepala recedit.

Plants small, herbaceous, perennating by narrowly ovate testicular tuberoids to 1 mm long. *Leaves* dimorphic: basal leaves green, 3–6, linear-oblanceolate, to 40 × 4 mm, acute to finely apiculate, the margins sometimes red, the upper subcauline with a purple-dotted sheath; cauline leaves reduced to membranous, brown-veined, to 15 mm long, acute sheaths, grading into the bract. *Flower* solitary, not resupinated, white except for vertical purple barring on the petal blades and a green galea sac, not scented. Ovary 10–20 long, exceeding the bract. Lateral sepals spreading, obovate, obtuse, obscurely apiculate, 10–17 × 8–15 mm. Dorsal sepal galeate, triangular in side view, laterally compressed, the apex attenuated, acute, somewhat reflexed, the back acute but without a developed spur, galea 10–15 mm tall and 4–6 mm deep, the entrance 3–5 mm wide. Petal limbs reflexed along the base of the galea, 4–6 × 1 mm; terminal blades obovate, ca. 5 × 3 mm, obtuse, upcurved geniculately behind the anther and twisted to face forward. Lip spreading, lorate to lorate-oblanceolate, acute, flat, 10–15 × 4–6 mm. Anther reflexed parallel to the petal limbs, 2.5 mm long, caudicles short and sharply upcurved. Rostellum equally three-lobed, 2 mm tall, robust, with the viscidia facing upward. Stigma small, horizontal, tripulvinate.

Ecology and distribution. There are only three known populations of *Disa virginalis*, and these are all geographically rather isolated. The species is restricted to south-facing rock ledges at ca. 1000 m. It does not appear to be essential that there is any water seepage: the habitat can thus be described as cool and dry. The plants occur in dense clusters, suggesting some form of vegetative reproduction, although there are no obvious means for

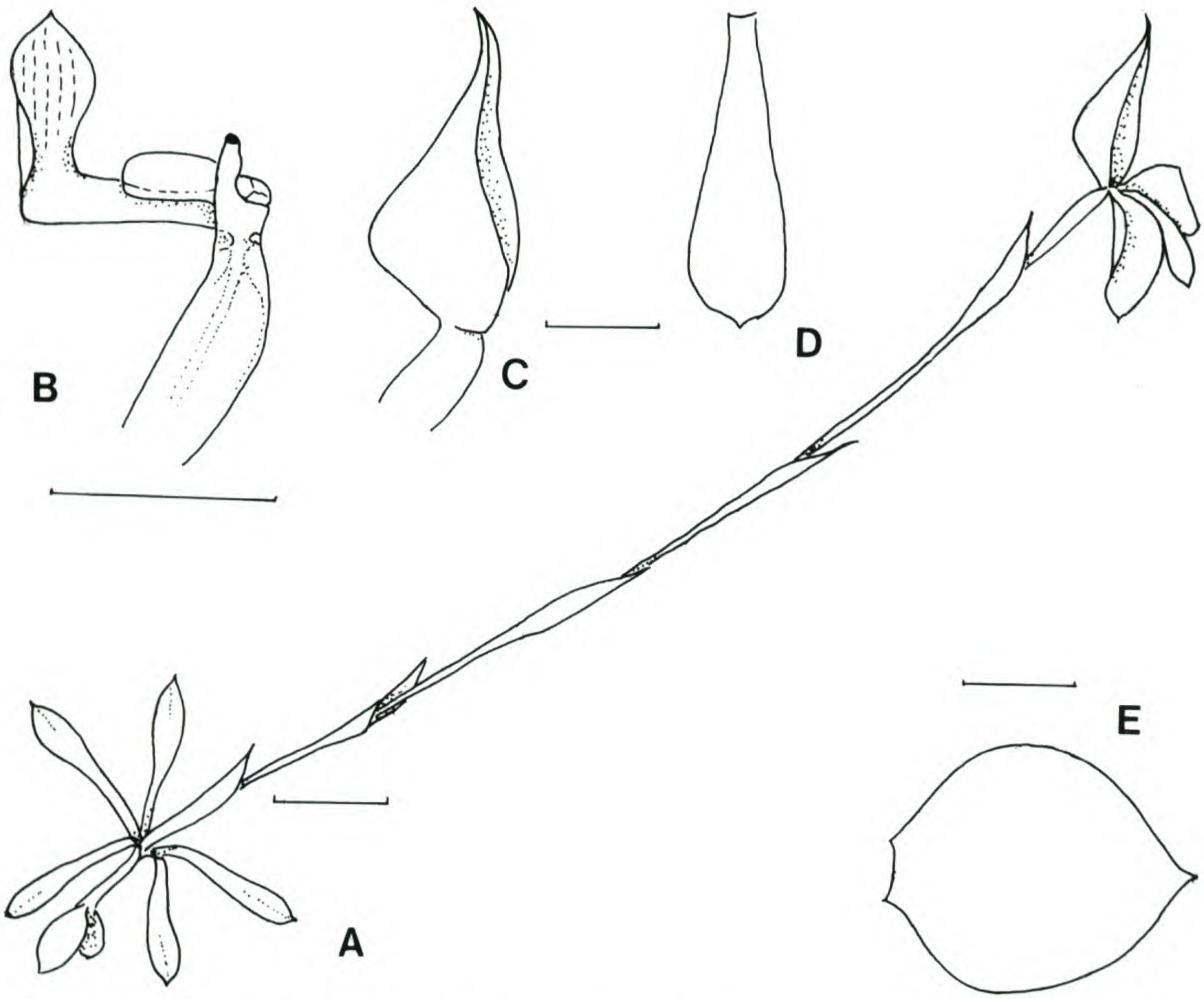


Figure 1. *Disa virginalis* H. P. Linder. —A. Flowering plant. —B. Gynostemium with one petal removed, showing petal reflexed next to reflexed anther, erect rostellum, and tripulvinate stigma; viscidium in black. —C. Dorsal sepal in side view. —D. Lip. —E. Lateral sepal. Scale bars: A = 10 mm, all others 5 mm. All from *Linder 6598.*

this. Flowering occurs during October, sometimes reaching into the beginning of November.

This species should be regarded as rare. Although all three populations are relatively protected, the small number of populations render the species vulnerable.

Etymology. The species epithet refers to the pure white flowers.

This new species was previously included in *Disa maculata* L.f. Linder (1981) regarded it as recessive form of *D. maculata.* However, he could not have studied collections of these white-flowered populations because he noted "There is almost no structural variation in this species." Although *D. virginalis* is clearly closely related to *D. maculata,* it differs as follows:

The lateral sepals are relatively wider. There is substantial variation in the sepal width in *D. maculata,* but they are never as wide as in *D. virginalis.* This has a profound impact on the appearance of the flowers because in *D. virginalis* the lateral sepals and lip overlap to form an extensive continuous expanse of tissue.

The base of the galea is shorter, and consequently the petal limbs, which lie along the base of the galea, are also shorter. As a result, the galea of *D. virginalis* is shallower than that of *D. maculata.*

The entrance to the galea is wide open in *D. maculata* but is laterally compressed in *D. virginalis.* This is not evident on preserved material, where the flowers are either flattened or to some extent collapsed.

The flowers are white, rather than blue. Eric H. Harley reported (pers. comm.) the presence of apparently recessive, white individuals from the Cape Peninsula population of the blue *D. maculata,* but they have none of the morphological features of *D. virginalis,* thus indicating that the morphological features of *D. virginalis* are not pleiotrophic effects of a recessive color change.

The habitats of the two species are subtly different. Although both are rock-ledge species, *D. ma-*

culata appears to grow on ledges that receive some moisture through seepages or drips and consequently is generally found in moss beds and among other ledge vegetation. Although some plants of *D. virginalis* may be found in moss beds, the majority grow on ledges and in cracks too dry for moss. Although the distribution ranges of the two species overlap, there may be only partial ecological overlap.

Disa virginalis shares many similarities with *D. schizodioides* Sonder. Both are small rock-ledge species, with radical leaves and solitary white flowers. The sepals and rostellum structures of the two species are virtually identical, and they differ largely in their petal and lip shapes. The petals of *D. schizodioides* have small erect blades, while the basal limbs are much more substantial. The lip is also much shorter, broader, and abbreviated. The two species are geographically isolated; *D. schizodioides* is a southern Cape species, found in the Langeberg and the Swartberg, which receive substantial summer rain, while *D. virginalis* is found in the mountains of the southwestern Cape, which receive almost no summer rain.

Linder (1981) grouped *Disa maculata* with *D. longicornu* in *Disa* subg. *Disa* sect. *Phlebidia* on the shared possession of basal leaves, dry leaf-sheaths, single blue flowers, and petal structure. Although *D. virginalis* has some of these characteristics, it has white flowers and shows close similarities to *D. schizodioides*, which is in section *Disa*. Yet there appears little doubt that it also has close similarities to *D. maculata*. No cladistic analysis of *Disa* subg. *Disa* is yet available, but it would appear that *D. maculata*, *D. virginalis*, and *D. schizodioides* form a natural group within this subgenus. This questions the usefulness of section *Phlebidia*, unless it is defined to include only *D. longicornu*. *Disa longicornu* is a rather peculiar species within subgenus *Disa*, where its long spur and the petal extensions are unique. It would not appear advisable at this stage to pronounce on the correct sectional taxonomy within subgenus *Disa*: this will have to await a phylogenetic analysis.

Paratypes. SOUTH AFRICA. **Western Cape:** Bainskloof, Limietberg, 18 Oct. 1966, *Oliver s.n.* (BOL); SE ridge of Bailey's Peak, 15 Nov. 1975, *Esterhuysen 34099* (BOL); Piketberg, seaside of summit of Kapteinskloof Mt., 21 Oct. 1945, *Pillans 7743* (BOL); Piketberg, SE slopes of Zebrakop, 9 Nov. 1934, *Pillans 7347* (BOL).

Acknowledgments. We thank Michael Raine for carefully measuring the herbarium material of these two species. The Foundation for Research Development is thanked for financial support.

Literature Cited

Johnson, S. D. 1994. Evidence for Batesian mimicry in a butterfly-pollinated orchid. Biol. J. Linn. Soc. 53: 91–104.

———. 1995a. Moth pollination of the cryptic Cape orchid *Monadenia ophrydea*. Flora 190: 105–108.

———. 1995b. Observations of hawkmoth pollination in the South African orchid *Disa cooperi*. Nordic J. Bot. 15: 121–125.

———. 1995c. Pollination, adaptation and speciation models in the Cape flora of South Africa. Taxon 45: 59–66.

——— & H. P. Linder. 1995. Systematics and evolution of the *Disa draconis* complex (Orchidaceae). Bot. J. Linn. Soc. 118: 289–307.

Linder, H. P. 1981. Taxonomic studies on the Disinae. III. A revision of the genus *Disa* Berg. excluding sect. *Micranthae*. Contr. Bolus Herb. 9: 1–370.

———. 1983. The historical phytogeography of the Disinae (Orchidaceae). Bothalia 14: 565–570.

———. 1986. Notes on the phylogeny of the Orchidoideae, with particular reference to the Diseae. Lindleyana 1: 51–64.

——— & H. Kurzweil. 1990. Floral morphology and phylogeny of the Disinae (Orchidaceae). Bot. J. Linn. Soc. 102: 287–302.

——— & ———. 1994. The phylogeny and classification of the Diseae (Orchidoideae: Orchidaceae). Ann. Missouri Bot. Gard. 81: 687–713.

Eight New Taxa and Two New Reports of Bambuseae (Poaceae: Bambusoideae) from Colombia

X. Londoño
Instituto Vallecaucano de Investigaciones Científicas-INCIVA, A.A. 5660, Cali, Colombia

Lynn G. Clark
Department of Botany, Iowa State University, Ames, Iowa 50011, U.S.A

ABSTRACT. Morphological characters support the description of seven new species and one variety of Bambusoideae from Colombia belonging to four genera of woody bamboos: *Arthrostylidium*, *Chusquea*, *Guadua*, and *Rhipidocladum*. The new species and variety are described, illustrated, and compared with putatively related species. They are *Arthrostylidium auriculatum*, *A. chiribiquetensis*, *A. punctulatum*, *A. virolinensis*, *Rhipidocladum abregoensis*, *Guadua angustifolia* var. *nigra*, *Chusquea antioquensis*, and *C. arachniforme*. A revised key to the South American species of *Arthrostylidium* is presented. Two genera of woody bamboos previously unknown in Colombia are documented to occur there. *Otatea*, thought to be restricted to Mexico and Central America, is found in northern Colombia, and *Merostachys*, widespread but with its diversity concentrated in southeastern Brazil, is reported from north-central Colombia.

Among the Andean countries, Colombia possesses a high diversity of woody bamboos. Londoño (1990) reported a total of 45 described species in seven genera for Colombia; just a few years later, Clark (1995) reported an estimated 63 species in eight genera for the country, without referring explicitly to the additional genus. Based on fieldwork by Londoño in 1994 and by Londoño and Clark over several years in the Andean region of Colombia, as well as examination of herbarium specimens, we here report that woody bamboo diversity in Colombia comprises nine genera and 62 described species, including those in the present paper, with an estimated species diversity of 90 including undescribed taxa. In this paper, we describe seven species and one variety new to science, and document the occurrence of two genera previously unknown in Colombia.

Two of the species, *Arthrostylidium auriculatum* and *Rhipidocladum abregoensis*, are known only from a single collection, but in each case, the plants were in flower, and qualitative differences are sufficient to distinguish them from related congeners. We present a key to the species of *Arthrostylidium* Ruprecht in South America, revised from Judziewicz and Clark (1993) to include the four species described here. Tables comparing *A. virolinensis* with the other three species of the genus with zig-zag/flexuous synflorescences, and *R. abregoensis* with two similar, narrow-leaved congeners are included.

Our interpretation of reproductive morphology follows that of Stapleton (1997) and Judziewicz et al. (in press). The spikelet is considered to be an inflorescence, based on which an aggregation of spikelets is here termed a synflorescence. The stalk of the spikelet is therefore a peduncle, and the axis of the spikelet is the rachis. The principal axis of the synflorescence is referred to as the main axis, and the branches are paraclades. A coflorescence is a set of one to several paraclades derived from a single axis; in our taxa, a coflorescence may consist of a single spikelet, a first-order paraclade bearing spikelets, or a first-order paraclade with higher orders of branching. We also note that in *Rhipidocladum* McClure and *Arthrostylidium*, the glumes, sterile lemmas, and fertile lemmas are not always morphologically very distinct from each other (Clark & Londoño, 1991). The glumes and sterile lemmas of *Chusquea* Kunth also intergrade frequently (Clark, 1996). We here refer to all of the empty bracts at the base of a spikelet as glumes, and all synflorescence bracts enclosing a bud as gemmiparous bracts.

NEW REPORTS

Merostachys Sprengel

During a visit to the herbarium at the University of Medellín (HUA) in June 1994, the authors identified two vegetative specimens representing what are probably two undescribed species of *Merostachys*. The Pohl specimen had been seen before, but its significance was unappreciated until we saw

both specimens together. Both records of this genus in Colombia are from Antioquia. Southeastern Brazil is the center of diversity for *Merostachys*, and although the genus extends into southernmost Chiapas, its occurrence outside of Brazil is generally as widely scattered populations.

COLOMBIA. **Antioquia:** Mun. Guatapé, Vereda Santa Rita, al borde de un pinar, casa de la finca Montepinar en bosque dominado por palmas, 7 Ago. 1986, *Pohl & Marulanda 15398* (HUA, ISC).

COLOMBIA. **Antioquia:** Mun. Vigia del Fuerte, Comunidad Indígena de Jarapetó, 20–25 m, 22 Mar. 1993, *Gomez 609* (HUA).

Otatea (McClure & Smith) C. Calderón & Soderstrom

Londoño discovered a population of *Otatea fimbriata* Soderstrom growing in a relatively dry region of northern Colombia in the department of Norte de Santander during fieldwork in April 1994. The identity of this vegetative collection was confirmed by Londoño and Clark, who has collected this species in Mexico. Until now, this genus was known only from Mexico and Central America, with most of its diversity in seasonally dry forests in Mexico (Clark, 1995). This is the only known population of this genus in South America, although it may be expected in seasonally dry habitats in western Venezuela.

COLOMBIA. **Norte de Santander:** Mun. Ocaña, Vereda San Luis, aprox. 4 km de Ocaña por la via a Abrego, a margen derecha del río Algodonal, 1270 m, 19 Abr. 1994, *Londoño, Amaya, Jácome & Forgioni 884* (COL, TULV).

New Species

Revised Key to the South American Species of *Arthrostylidium*

1a. Lowest internode of culm 3–6 m long, much longer than the very short 1–10-cm-long succeeding internode; lemma awns 4–7 mm long . . . . . *A. schomburgkii*

1b. Lowest internode of culm less than 1 m long, about the same size as succeeding internodes; lemmas awnless or with awns at most 3(–5) mm long.

2a. Culm nodes with flaring, corky, shieldlike outgrowths about twice the diameter of the culm . . . . . *A. scandens*

2b. Culm nodes with shieldlike outgrowths absent or very small, less than 1 mm wide.

3a. Axes of the coflorescences zig-zag or less commonly flexuous.

4a. Culm leaf blades reflexed; internodes retrorsely scabrid; spikelets 2.5–4 cm long with 5–9 fertile florets per spikelet . . . . . *A. ecuadorense*

4b. Culm leaf blades erect; internodes glabrous; spikelets 1–1.7(–3) cm long with (2–)3–5 fertile florets per spikelet.

5a. Culm leaves 3–6.5 cm long; foliage leaf blades 0.2–0.45 cm wide; glumes obtuse, the midnerve glabrous; lemmas 4–4.5 mm long; paleas purplish, the keels glabrous . . . . . *A. virolinensis*

5b. Culm leaves 7.5–25 cm long; foliage leaf blades 0.4–1.4 cm wide; glumes acute to apiculate or shortly mucronate, the midnerve scabrous; lemmas (5–)6–10 mm long; paleas yellowish to stramineous, often with purple margins, the keels ciliolate.

6a. Foliage leaf blades 4–6 cm long, 0.4–0.6 cm wide; 3–5 spikelets per coflorescence; (2–)4–5 fertile florets per spikelet . . . . . *A. sarmentosum*

6b. Foliage leaf blades 7–14.5 cm long, (0.7–)0.9–1.4 cm wide; (4–)5–8 spikelets per coflorescence; 3–4 fertile florets per spikelet . . . . . *A. venezuelae*

3b. Axes of the coflorescences straight.

7a. Nodal line bearing a ring of retrorsely spreading cilia; coflorescences 2.5–3.5 cm long, bearing 2–5 spikelets . . . . . *A. fimbrinodum*

7b. Nodal line glabrous; coflorescences (4–)5–30(–40) cm long, bearing 4–19(–25) spikelets.

8a. Lemmas with awns 1.5–3(–5) mm long . . . . . *A. simpliciusculum*

8b. Lemmas awnless or with awns less than 1.5 mm long.

9a. Foliage leaves with inner ligules 6–10 mm long, the blades 5–7 cm wide . . . . . *A. grandifolium*

9b. Foliage leaves with inner ligules 0.1–1 mm long, the blades 0.9–5 cm wide.

10a. Foliage leaf sheaths bearing true auricles at the apex . . . . . *A. auriculatum*

10b. Foliage leaf sheaths lacking true auricles.

11a. Internodes pithy in the middle with longitudinal air canals toward the periphery; culm leaf blades inflated near the junction with the sheath; spikelets strongly diverging from the axis of the coflorescence . . . . . *A. chiribiquetensis*

11b. Internodes hollow with thick walls, longitudinal air canals absent; culm leaf blades not inflated; spikelets appressed to the axis of the coflorescence.

12a. Foliage leaf blades 2–5 cm wide; spikelets 2.5–5 cm long; fertile florets 5–14 per spikelet.

13a. Culm leaves uniform in color, blades ca. twice as long as

the sheaths; branch complement with a strongly dominant primary branch and several smaller secondary branches; fertile florets 10–14 per spikelet; lemmas 13–16 mm long, uniform in color; coastal cordillera of Venezuela . . . . . *A. longiflorum*

13b. Culm leaves maculate when young, blades ± equal to the sheaths; branch complement with all branches subequal; fertile florets 5–10 per spikelet; lemmas 9–10.5 mm long, maculate; eastern cordillera of Colombia . . . *A. punctulatum*

12b. Foliage leaf blades 0.9–2.3(–2.8) cm wide; spikelets 1.3–3 cm long; fertile florets 2–5(–6) per spikelet.

14a. Culm leaves with sheaths hispid, the blades with truncate bases; foliage leaf blades (5–)7–11 per complement, 0.9–1.4(–2) cm wide; spikelets 2.2–3 cm long, rachis internodes 5–7 mm long . . . . . *A. pubescens*

14b. Culm leaves with sheaths glabrous or nearly so, the blades usually with oblique bases; foliage leaf blades 3–5 per complement, 1.3–2.3(–2.8) cm wide; spikelets 1.3–2.3 cm long, rachis internodes 2–3 mm long . . . . . *A. youngianum*

Arthrostylidium auriculatum Londoño & L. G. Clark, sp. nov. TYPE: Colombia. Antioquia: Mun. Amalfi, Km 11.6 de la via Amalfi-Porce, a orilla de la Quebrada Caracolí, 1510(–2000) m, 15 jun. 1994, *X. Londoño & L. G. Clark 895* (holotype, HUA; isotypes, AAU, COL, ISC, JAUM, K, MEDEL MO, NY, TULV, US). Figure 1.

Bambusa lignosa. Rhizoma sympodiale pachymorphum. Culmi 2–4 m alti, 2–3 mm diam. cylindrici graciles cavi. Folia culmorum persistentia ad basem; basi vaginarum annulati incrassati induratique. Ramificatio intravaginalis, supra promontorium, rami 3–5, ramo centrali subdominanti. Vaginae foliorum pubescens biauriculatae, auriculis tortilibus, longifimbriatis; laminae foliorum lanceolatae vel lineari-lanceolatae, 5–16 × 1.2–2.5 cm, abaxialiter pubescens. Synflorescentiae ramos terminantes, 15–30 cm longae, 1–5 coflorescentibus, racemiformibus, spicula 7–19 multiflora. Spiculae 1.3–2.2 cm longae; glumae 3; flosculi fertiles 2–3 et anthoecium rudimentale terminale.

Woody bamboo. *Rhizome* sympodial, pachymorph. *Culms* 2–4 m long, 2–3 mm diam., scandent, scrambling to hanging above. *Internodes* 30–49 cm long, the basal ones 4.5–20 cm long, cylindrical, hollow, lumen 0.5–1 mm diam., glabrescent, green when young becoming yellowish to straminеous. *Bud* one per node, positioned ca. 1.5–2.5 mm above the nodal line, terminal to a promontory. *Branching* intravaginal, 3–5 branches per node, with one slightly dominant central branch from a segmented promontory 4–6 mm above the nodal line. *Culm leaves* stramineous, appressed to culm, basally persistent, rotting in place, strongly attached by a basal, dark, well-marked, corky flange, the middle and upper ones pushed away by the developing axillary branches; *sheaths* 4–8 cm long, abaxially pubescent, ciliate along one margin; *blades* erect. *Foliage leaves* 4–6 per complement (from flowering material); *sheaths* green when young, turning stramineous, abaxially pubescent, strongly nerved, bearing auricles and fimbriae at the summit, ciliate along one margin, strongly attached at the base; *auricles* 1–2.5 mm long, fimbriate, purplish brown, twisted; *fimbriae* 5–8 mm long, purplish to brown, smooth, straight to sinuous, rigid basally, arching apically; *outer ligule* less than 0.3 mm long, glabrous, shiny; *inner ligule* 0.5 mm long, pubescent; *pseudopetiole* 3–5 mm long, glabrous, purplish, twisted; *blades* 5–16 cm long, 1.2–2.5 cm wide, lanceolate to linear-lanceolate, 14–15-nerved, adaxially glabrous, abaxially tomentose, the midnerve slightly manifest basally, the base rounded-truncate, the apex acuminate, the margins scabrous. *Synflorescences* usually terminating leafy branches of all orders, consisting of 1–5 coflorescences, these separated by internodes 4–8 cm long. *Coflorescences* 15–30 cm long, erect to arching, consisting of 1 subtending bract, 1 prophyll, 0–1(–2) gemmiparous bracts, and 7–19 multiflowered spikelets, these separated by internodes 0.3–2 cm long, the axis straight, hispidulous to glabrescent; *subtending bract* throughout the main axis like a fully developed branch leaf with fimbriate auricles at the summit and a deciduous blade, varying to a narrowly triangular bract, 2.6–3 cm long, 2–3 mm wide, 7-nerved, adaxially glabrous, abaxially hispidulous, mucronate, the mucro 0.5–1 mm long, the margins ciliate; *prophyll* a thin, transparent membrane, 13–27 mm long, 1.2–3 mm wide, glabrous, 2-keeled, the keels ciliate; *gemmiparous bracts* 1.5–3 cm long, 2–3 mm wide, membranaceous, glabrous. *Spikelets* 1.3–2.2 cm long (estimated from young spikelets and disarticulated florets), slenderly lanceolate, purplish green when young then stramineous, puberulous, apparently with scattered siliceous deposits on the surface, erect and appressed to the main axis, consisting of 3 glumes, 2–3 fertile florets, and a terminal rudimentary floret, pedun-

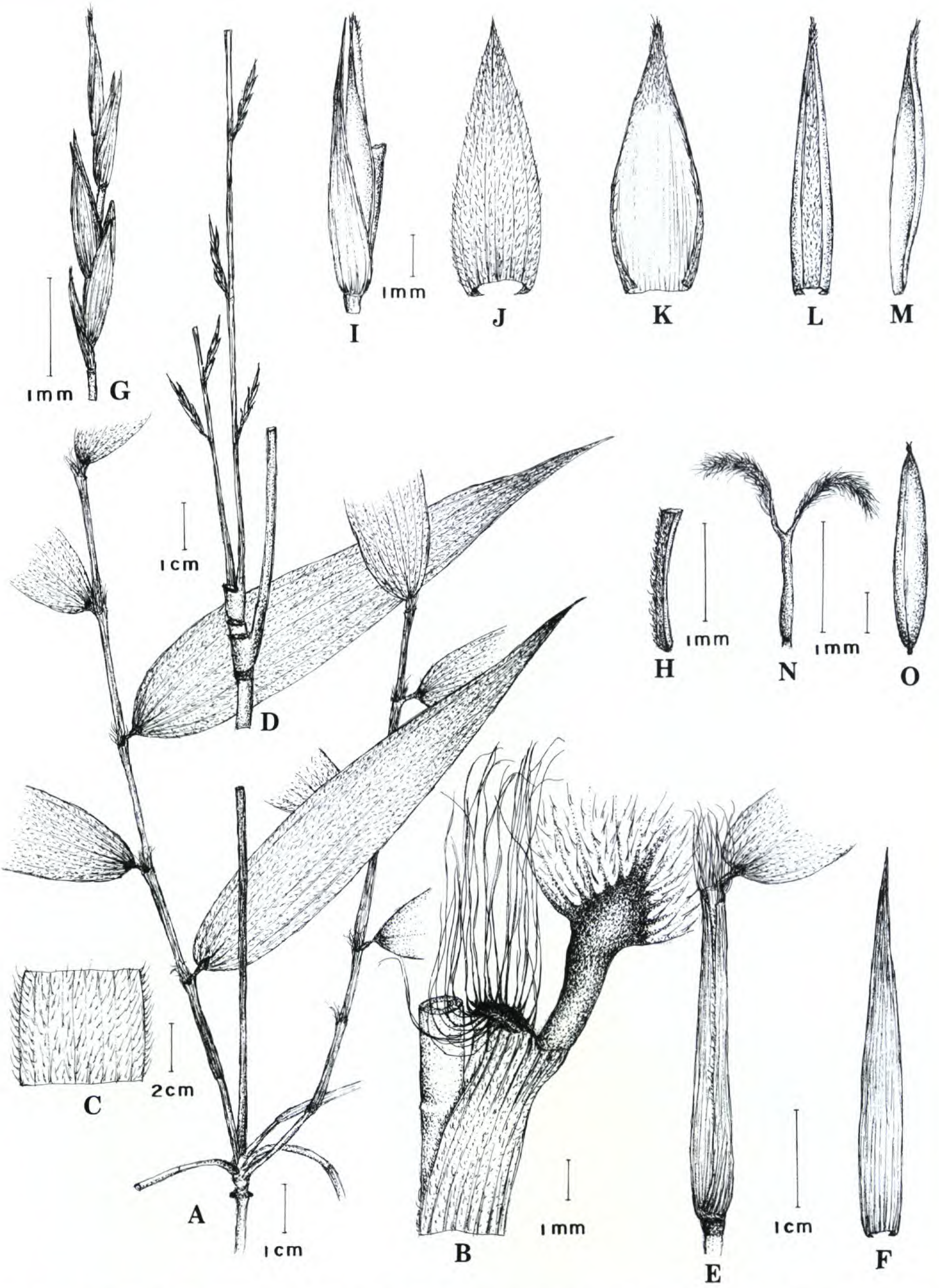


Figure 1. *Arthrostylidium auriculatum* Londoño & L. G. Clark. —A. Branch complement with foliage leaves. —B. Foliage leaf, ligular area. —C. Detail of blade showing appressed hairs. —D. Flowering branch. —E. Subtending bract. —F. Prophyll, adaxial view. —G. Spikelet. —H. Rachis internode. —I. Fertile floret. —J, K. Lemma, abaxial and adaxial views. —L, M. Palea, adaxial and side views. —N. Gynoecium. —O. Caryopsis. (Based on *Londoño & Clark 895.*)

culate, the peduncles 0.5–0.8 mm long; *rachis* segments 3–5 mm long, ½–⅔ the length of the floret, the upper ⅓ hispidulous, flat, disarticulating just below the next lemma; *glumes* 4.5–6 mm long, 1–2 mm wide, ovate-lanceolate, 3-nerved, apiculate, marginally ciliate, abaxially puberulous, adaxially glabrous and puberulous toward the apex; *lemmas* 6–7.5 mm long, 2–2.5 mm wide, shorter than or equal to the palea, 7–8-nerved, ovate-lanceolate, mucronate, ciliate along one margin, adaxially glabrous but densely pubescent on the upper ⅓, abaxially puberulous, the mucro 0.4–0.6 mm long, the midnerve prominent only distally; *palea* 6–7.5 mm long, 0.8–1.3 mm wide, usually equaling or slightly longer than the lemma, 2-keeled, 1-nerved between the keels, adaxially glabrous, abaxially puberulous, the margins of the palea glabrous. *Lodicules* and *stamens* not seen. *Ovary* fusiform, glabrous, 1–1.1 mm long; style 1, stigmas 2, yellowish brown, plumose, up to 1.5 mm long. *Fruit* a caryopsis, 5.5 mm long, 0.7–1 mm wide, reddish brown, glabrous, the hilum side slightly curved, the embryo side flattened; *embryo* ⅐ the caryopsis length; *hilum* purplish, as long as the caryopsis but more prominent basally; *style base* 0.3 mm long, persistent, glabrous, lighter in color than the caryopsis.

Distribution. At the northern extreme of the Central Cordillera of Colombia, in the Department of Antioquia, Mpio. Amalfi; on steep slopes in montane forest; 1500–2000 m.

Arthrostylidium auriculatum is distinguished by the presence of fimbriate auricles at the summit of the foliage leaf sheaths, tomentose abaxial surfaces of the foliage leaf blades, hispidulous to glabrescent coflorescence axes and rachis segments, puberulous spikelets apparently with scattered siliceous deposits on the surface, and lemmas shorter than or equal to the paleas and abaxially puberulous. This unusual species is known only from the type collection. The true auricle in this species is unique in the genus. The so-called auricle of *A. grandifolium* Judziewicz & L. G. Clark (Judziewicz & Clark, 1993) is a sheath summit extension, not homologous to the true, blade-derived auricle (Judziewicz et al., in press). *Arthrostylidium auriculatum* and *A. grandifolium* do share thick-walled internodes up to 50 cm long, but otherwise are readily distinguishable (see Key).

Arthrostylidium chiribiquetensis Londoño & L. G. Clark, sp. nov. TYPE: Colombia. Caquetá: Sierra de Chiribiquete, bosque en la base de la Mesa Norte, 1°05′N, 72°40′W, 600 m, 26 ago. 1992 (fl), *P. Palacios, P. Franco, O. Rangel & J. Betancur 2681* (holotype, COL; isotypes, COAH, FMB, MA, US). Figure 2.

Bambusa lignosa cespitosa. Rhizoma sympodiale pachymorphum. Culmi 3–5 m alti, 3–6 mm diam. scandentes cylindrici scabridi, centro meduloso et longitudinalibus canalis aeriarum epidermidem versus; internodiis 7–52 cm longis. Folia culmorum erecta appressa; vagina culmorum longifimbriata; basi laminarum culmorum coriacea fuscata zona signata. Ramificatio intravaginalis supra promontorium, ramo central dominanti 2–4 lateralibus brevibus. Vaginae foliorum longifimbriatae, laminae foliorum ovato-lanceolatae, (6–)12–15(–18.5) × 2–5 cm, utrinque glabrae et tessellatae. Synflorescentiae 2–5 coflorescentibus, spicula 10–18 multiflora. Spiculae (5–)9–17 mm longae, angulo (60–)75–130° a axe divergentes; glumae 1–2; flosculi fertiles 2–3 et anthoecium rudimentale terminale. Ovarium fusiforme, glabrum, 0.7–1 mm long; stylus 1; stigmata 2.

Caespitose woody bamboo. *Rhizomes* short, sympodial. *Culms* 3–5 m long, 3–6 mm diam., at first erect then scandent and climbing. *Internodes* 28–52 cm long, the basal ones 7–25 cm long, cylindrical, pithy in the middle with longitudinal air canals toward the epidermis, scabrid, covered by short, retrorse, strigose hairs. *Bud* one per node, positioned 2–3 mm above the nodal line, terminal to a slight promontory. *Branching* at mid-culm nodes intravaginal, with one primary central branch and 2–4 smaller, secondary branches on a promontory 2–4 mm long. *Culm leaves* erect and appressed to culm, stramineous; *sheaths* 3.5–5 cm long, 1–1.5 cm wide, adaxially glabrous, abaxially puberulous to glabrous, margins papery and smooth, fimbriate at the summit; *fimbriae* weak, short, 2 mm long, curled; *inner ligule* a narrow, stramineous, shiny and ciliolate membrane 0.2 mm wide; *outer ligule* absent; *blades* 1–4 cm long, 0.9–2 cm wide at the base, erect, persistent, mucronate, triangular, inflated at the junction with the sheath, with a coriaceous, darker zone 1–2.5 mm wide at the base, glabrous on both surfaces except pubescent apically and along the margins, the margins ciliate. *Foliage leaves* 9–14 per complement; *sheaths* shorter than or equal to the internode, 2.5–4 cm long, glabrous to glabrescent, striate, bearing fimbriae at the summit, margins papery, ciliolate to smooth; *fimbriae* 5–10 mm long, reddish, smooth, rigid basally, curled apically; *inner ligule* 0.8–1 mm long, pubescent and ciliate; *outer ligule* ca. 0.2 mm long, glabrous, shiny and ciliolate; *pseudopetiole* 2–5 mm long, twisted, adaxially dark green and hispidulous, abaxially yellowish and glabrous, extending 1.5–2 mm onto the lower surface of blade as a triangular patch; *blades* (6–)12–15(–18.5) cm long, 2–5 cm wide, ovate-lanceolate, glabrous and conspicuously tessellate on both surfaces, abaxially with the apex covered by appressed, transparent hairs, the midnerve yellowish, only manifest basally, the base slightly truncate, the apex shortly acu-

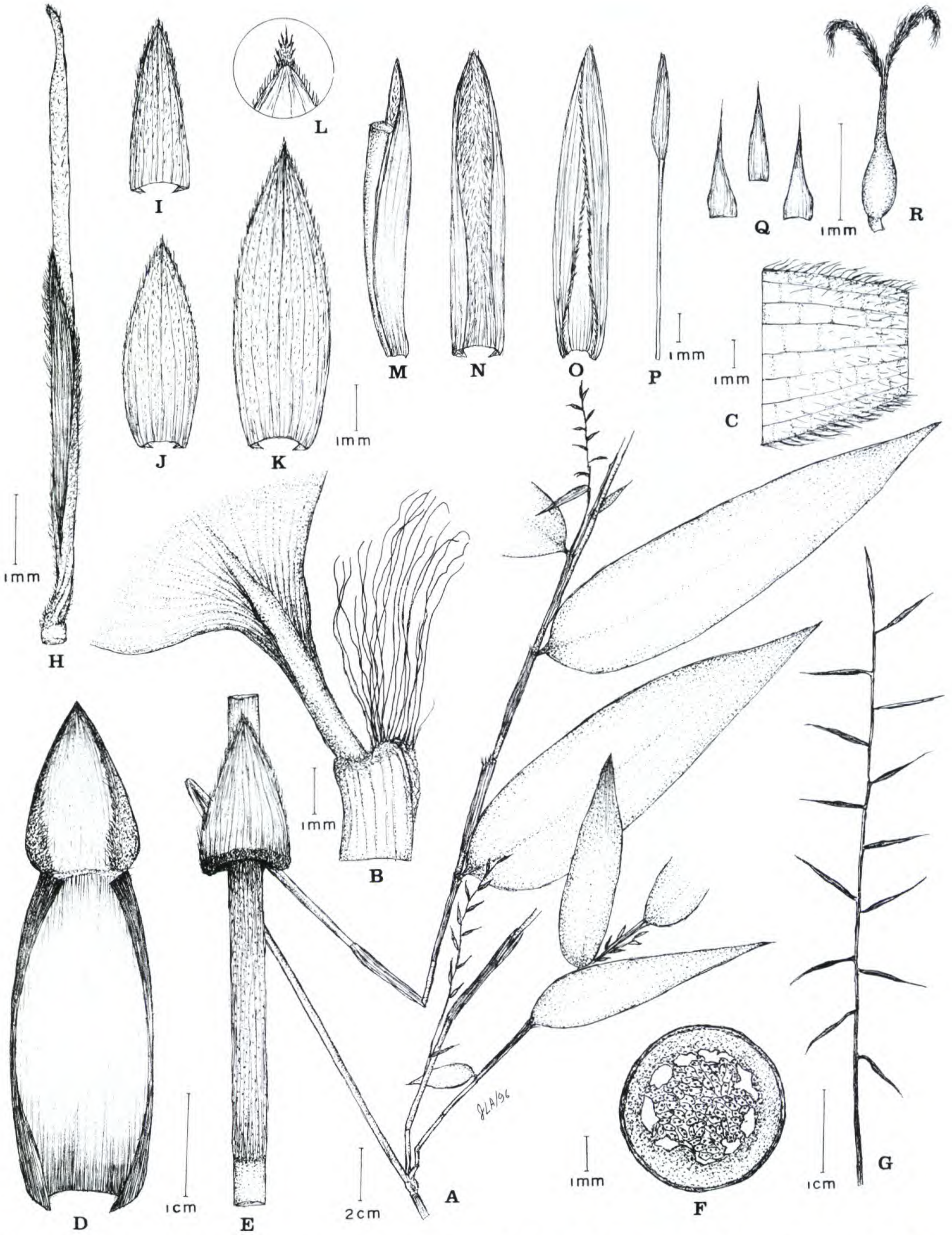


Figure 2. *Arthrostylidium chiribiquetensis* Londoño & L. G. Clark. —A. Flowering branch complement. —B. Foliage leaf, ligular area. —C. Detail of blade showing tessellate venation and adpressed hairs toward the apex. —D. Culm leaf, adaxial view. —E. Culm leaf *in situ*, showing the inflated junction of the blade and the sheath. —F. Cross section of culm showing peripheral air canals. —G. Synflorescence. —H. Spikelet. —I, J. Glumes, abaxial views. —K. Lemma, abaxial view. —L. Apex of lemma, showing prickly mucro. —M. Palea, side view. —N, O. Palea, adaxial and abaxial views. —P. Terminal rudimentary floret. —Q. Lodicules. —R. Gynoecium. (A, C, G–R based on *Palacios et al. 2681*; B, D, E based on *Palacios et al. 2809*; F based on *Cardiel et al. 1304*.)

minate. *Synflorescences* usually terminating leafy branches of all orders or borne directly from nodes, consisting of 2–5 coflorescences, these separated by internodes 4–8.5 cm long. *Coflorescences* 8–17 cm long, erect, each consisting of 1 subtending bract, 1 prophyll, 1–2 gemmiparous bracts, and 10–18 multiflowered spikelets, these separated by internodes (0.2–)0.5–1 cm long, the axis striate, straight to slightly twisted, glabrous to hispidulous, sulcate above each spikelet; *subtending bract* throughout the main axis like a fully developed branch leaf with fimbriae at the summit, usually with a persistent blade, varying to a narrowly triangular bract 1.5–2.7 cm long, 3–4 mm wide, 13–14-nerved, glabrous, shortly mucronate, papery and ciliate on the margins; *prophyll* (4–)9–18 mm long, 0.8–2.5 mm wide, yellowish, glabrous to hispidulous, 2-keeled, 1-nerved between the keels, 2-nerved on each enfolding margin, the apex with a tuft of hairs, the margins sparsely ciliolate to smooth; the keels winged, the wings 0.2–0.4 mm wide, ciliate; *lower gemmiparous bract* 11–20 mm long, 1–2.5 mm wide, stramineous, glabrous, with a tuft of hairs at the apex, 10–14-nerved, shortly mucronate, the mucro 0.1 mm long, subapical, prickly; *upper gemmiparous bract* 18–25 mm long, 2–3 mm wide, 8–16-nerved, developing a small, adaxially pubescent blade, 2–4 mm long, pseudopetiolate or not, sheath glabrous, bearing fimbriae at the summit. *Spikelets* (5–)9–17 mm long, 0.6–0.8 mm wide, slenderly lanceolate, green-yellowish when young then stramineous, pedunculate, the peduncle 0.5–1 mm long, hispidulous, adaxially pulvinate, divergent (60–)75–130° from the main axis, consisting of 0–2 gemmiparous bracts, 1–2 glumes, 2–3 fertile florets, and a terminal rudimentary floret; *rachis* segments ½ to ⅕ the length of the floret, the internodes between glumes 0.7–1 mm long, between florets 6.5–7 mm long, prolonged up to 7.5 mm past the last lemma, smooth except the scabrid margins, flat, disarticulating just below the next lemma; *glumes* 1–2, unequal, triangular, acute to slightly mucronate, margins ciliolate, adaxially glabrous with appressed, hyaline hairs at the upper ⅓, abaxially pubescent, 5–7-nerved, the midnerve prominent; lower glume 3–4 mm long, 1.1–1.4 mm wide; upper glume 4.3–5.5 mm long, ca. 1.5 mm wide; *lemmas* 5.5–8.5 mm long, 2–2.5 mm wide, shorter than or equal to the palea, 7–8-nerved, ovate-lanceolate, mucronate, the margins papery basally, ciliolate in the upper ½, abaxially pubescent, covered by strigose, antrorse, short, transparent hairs, adaxially glabrous and shiny with appressed transparent hairs on the upper ⅓, the mucro prickly, 0.3 mm long; *palea* 6.5–8.1 mm long, 0.5–1 mm wide, usually equaling or slightly longer than the lemma, 2-keeled, 1-nerved between the keels, each margin 2-nerved, densely pubescent between the keels, the margins glabrous and ciliolate, the apex with a conspicuous tuft of hyaline hairs. *Lodicules* 3, 1.5 mm long, 0.3 mm wide, membranaceous, brownish, vasculated, abaxially pubescent, ciliate on the margins. *Stamens* not seen. *Ovary* fusiform, glabrous, 0.7–1 mm long; style 1, ca. 0.5 mm long; stigmas 2, plumose, 1.5 mm long, lighter in color than ovary. *Fruit* not seen.

Distribution. Southeastern Colombia; known from only a few collections in the Serranía de Chiribiquete, Dept. of Caquetá, expected to occur in the Dept. of Guaviare; lowland *terra firme* rainforest; 600–650 m.

Arthrostylidium chiribiquetensis can be distinguished by its pithy, canaliculate and scabrid culms; basally inflated culm leaf blades; conspicuously tessellate foliage leaf blades, with the apex covered by appressed and transparent hairs on the abaxial side; reddish fimbriae 5–10 mm long at the summit of the foliage leaf sheath; and coflorescences bearing spikelets divergent up to 130° from the axis. This species shares large, glabrous foliage leaf blades, foliage leaf sheaths shorter than internodes, racemiform paraclades, and pedunculate spikelets with *A. grandifolium* (Judziewicz & Clark, 1993). These two species have the largest blades so far known in the genus.

The Serranía de Chiribiquete occurs within the Colombian Guayana, which is geologically and phytogeographically related to the Guayana region (Sanchez P. et al., 1990; Estrada & Fuertes, 1993). This implies that *A. chiribiquetensis* may be most closely related to species of *Arthrostylidium*, such as *A. scandens*, from the Guayana region, but a more formal analysis of relationships within the genus is needed to test this hypothesis.

Paratypes. COLOMBIA. **Caquetá:** Parque Nacional Natural Chiribiquete, base de los cerros cercanos al abrigo norte del campamento base, bosque de *Cespedesia*, 25 nov. 1992 (fl), *Barbosa, Cortes, Palacios & Rangel 8039* (COL); alrededores del campamento base, 0°56′15″N, 72°42′06″W, bosque denso de 20 m de alto, 645 m, 24 nov. 1992 (fl), *Cardiel, Pedrol, Tellería & Velayos 1304* (COL, MA); alrededores del refugio de la selva, 1°4′23″N, 72°44′W, en suelo de selva alta, 630 m, 1 dic. 1992 (fl), *Velayos, Cardiel, Pedrol & Tellería 6511* (COL, MA); cerca del campamento base, 0°56′15″N, 72°42′06″W, 600 m, 27 nov. 1992, *Palacios, Barbosa, Cortes & Rangel 2809* (COL, MA); Sierra de Chiribiquete, entre el río de los musgos y el arco del triunfo, 1°05′N, 72°40′W, 600–650 m, 18–19 ago. 1992, *Franco, Rangel, Palacios & Betancur 3822 & 3878* (COL).

Arthrostylidium punctulatum Londoño & L. G. Clark, sp. nov. TYPE: Colombia. Departamento de Santander: Municipio de Charalá, Corregimiento de Virolín, 1850 m, 13 May 1982 (fl), *S. Diaz-Piedrahita 3399* (holotype, COL). Figure 3.

Bambusa lignosa. Rhizoma sympodiale pachymorphum. Culmi 4–7 m alti, 5–10 mm diam., cylindrici, cavi; internodia 18–51 cm longa. Folia culmorum maculata; sutura laminorum cum vagina manifeste asymmetrice curvata, unus margo basim versus prolongatum anguste alatum. Ramificatio intravaginalis; rami cujusquisque nodi 6–8(–12), ramus centralis non dominans. Vaginae foliorum maculatae longifimbriatae; laminae foliorum ovato-lanceolatae, 10–22 × 2–4 cm, adaxialiter glabrae, ad apicem pubescentem ciliatoque. Synflorescentiae ramos terminantes, 2–3 coflorescentibus, spiculae 4–8 multiflorae. Spiculae 2.5–5 cm longae; glumae 2–3; flosculi fertiles 5–10 et anthoecium rudimentale terminale. Ovarium fusiforme, glabrum, ca. 1 mm longum; stylus 1; stigmata 2.

Woody bamboo. *Rhizome* sympodial. *Culms* 4–7 m long, 5–10 mm diam., erect when young, arching and scandent when the branches develop. *Internodes* 18–51 cm long, cylindrical, hollow, smooth, glabrous, green when young becoming slightly maculate with green and yellow spots, the walls 0.5–1 mm thick, thin, splitting easily. *Bud* one per node, triangular, slightly elongated, positioned on a promontory 3–5 mm long. *Branching* at mid-culm nodes intravaginal, the branch complement of 6–8(–12) subequal branches, the primary branch no larger than the secondary branches. *Culm leaves* erect and appressed to the culm, the basal ones persistent and rotting in place, strongly attached by a basal green or purple flange 0.5 cm wide, the middle and upper ones pushed away by developing axillary branches; *sheaths* 7.5–15 cm long, 3–5 cm wide at the base, glabrous, maculate with yellow and purple spots when young, becoming mottled and stramineous, adaxially shiny and tessellate, the margins smooth; *inner ligule* 0.5 mm long, truncate, shiny, brown, abaxially pubescent, adaxially glabrous, asymmetrically curved, ciliolate along the margin; *blades* 5–11 cm long, 1.8–3.2 cm wide at the base, erect, persistent, triangular, adaxially glabrous except pubescent along the margins and the upper ⅓, abaxially pubescent, green, slightly maculate with yellow and green spots when young becoming stramineous, drying rapidly before the sheath, the junction with the sheath an asymmetrically curved line extending nearly all the way down along one side of the sheath and forming a narrowly winged and papery membrane, the margins ciliate, the apex acute to mucronate. *Foliage leaves* 4–6(–9) per complement; *sheaths* maculate, striate, glabrous except puberulous at the margins, with abundant, minute "papillae," tessellate near the papery, ciliolate to smooth margins, bearing fimbriae at the summit; *fimbriae* 6–10 mm long, reddish to stramineous, basally rigid and scabrid, apically curled and smooth; *inner ligule* 0.8–1 mm long, pubescent, ciliate; *outer ligule* 0.3–0.5 mm long, glabrous, shiny, stramineous, ciliolate; *pseudopetiole* 4–6(–7) mm long, stout, purplish to black, adaxially hispidulous, abaxially puberulous, extending 2–4 mm onto the lower surface of the blade as a darker triangular patch; *blades* 10–22 cm long, 2–4 cm wide, ovate-lanceolate, striate, pubescent, and ciliate, adaxially glabrous and tessellate, with 4–6 raised, scabrid, submarginal nerves on one side of the lower ⅓, abaxially pilose to glabrous, conspicuously tessellate, the midnerve yellowish, manifest only basally, the base obtuse, the apex narrowly acuminate. *Synflorescences* usually terminating leafy branches of all orders or borne directly from nodes, consisting of 2–3 coflorescences, these separated by internodes (1.5–)2.5–4.5 cm long. *Coflorescences* 10–15 cm long, erect, each consisting of 1 subtending bract, 1 prophyll, 1 gemmiparous bract, and 4–8 multiflowered spikelets, these separated by internodes (0.6–)1.5–2.6 cm long, the axis striate, straight to slightly twisted, hispid, densely so just below the spikelet, sulcate above each spikelet, the segment below the main terminal spikelet elongated up to 3 cm; the peduncle 0.5–1 mm long, hispid; *subtending bract* throughout the main axis like a fully developed branch leaf, with fimbriae at the summit, the blade persistent or deciduous, the sheath 5–6 cm long, maculate; *prophyll* 9–15 mm long, 0.8–1 mm wide, stramineous, hispid, 2-keeled, the apex ciliate, the margins smooth and papery, the keels winged, the wings ca. 0.2 mm wide, ciliate and pubescent; *gemmiparous bract* 11–18 mm long, 1–1.5 mm wide, 5–7-nerved, membranaceous, narrowly triangular, acute, stramineous, glabrous, the margins ciliolate. *Spikelets* 2.5–5 cm long, 0.3–0.6 cm wide, linear-lanceolate, maculate with green spots, pedunculate, consisting of 2–3 glumes, 5–10 fertile florets, and a terminal rudimentary anthecium; *rachis* on lowest internodes between glumes 0.5–0.7 mm long, between florets 3–5 mm long, hispid, disarticulating just below the next lemma; *glumes* 2–3, unequal, stramineous, adaxially glabrous with tiny, hyaline, appressed hairs on the upper ⅓ and along the midnerve, abaxially glabrous except for the scabrid midnerve, the margins ciliate, the cilia more evident on the upper ⅓; *lower glume* 3.5–5.5 mm long, 0.7–2.5 mm wide, triangular, acute, 1-nerved, with the midnerve prominent, asymmetrical and rough; *middle glume* when present 5–7 mm long, 2–3 mm wide, 4–6-

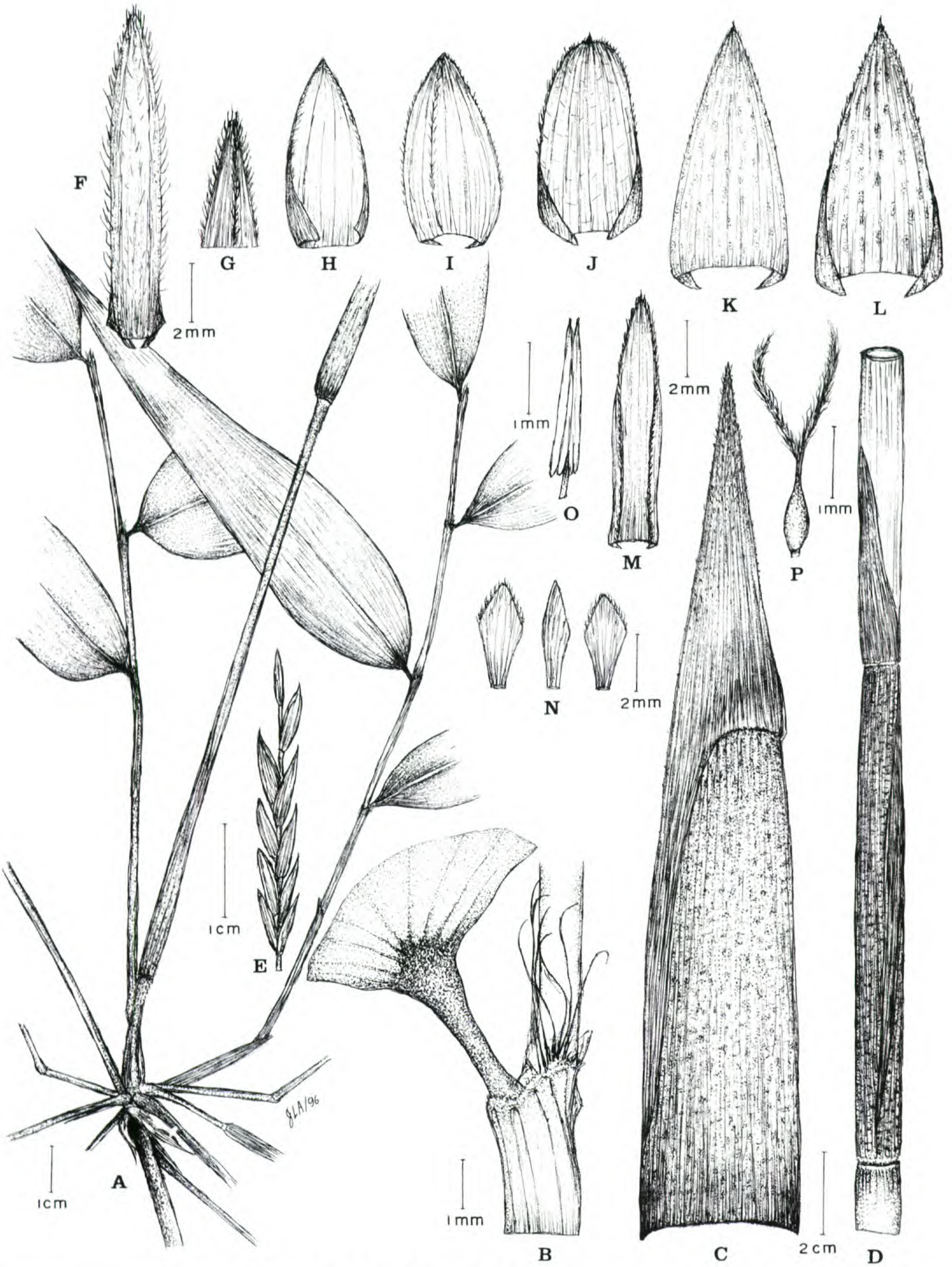


Figure 3. *Arthrostylidium punctulatum* Londoño & L. G. Clark. —A. Branch complement. —B. Foliage leaf, ligular area. —C. Culm leaf, abaxial view. —D. Culm leaf, *in situ*. —E. Spikelet. —F. Prophyll, adaxial view. —G. Lower glume, abaxial view. —H, I. Middle glumes, adaxial and abaxial views. —J. Upper glume, adaxial view. —K, L. Lemma, abaxial and adaxial views. —M. Palea, adaxial view. —N. Lodicules. —O. Anther. —P. Gynoecium. (A–D based on *Londoño & Kvist 802*; E–P based on *Diaz-Piedrahita 3399*.)

nerved, lanceolate-ovate, acute-mucronate; *upper glume* 6.5–8 mm long, 2.5–3 mm wide, 7–9-nerved, lanceolate-ovate, mucronate; *lemmas* 9–10.5 mm long, 4–5 mm wide, 7–10-nerved, longer than the palea, ovate-lanceolate, maculate, acute-mucronate, adaxially glabrous except pubescent on the upper ⅓, abaxially glabrous with a patch of hyaline, hispid hairs at the junction with the rachis, margins ciliolate; *palea* 8–9.5 mm long, 1.5–1.8 mm wide, the sulcus pubescent, 3-nerved, acute at the apex, 2-keeled, the keels ciliate, the enfolded margins glabrous, 3-nerved. *Lodicules* 3, 2–4 mm long, 0.5–1 mm wide, membranaceous, vasculated, transparent to brownish, ciliolate on the margins. *Stamens* 3, the anthers 2–2.5 mm long, brownish, sagittate at the base. *Ovary* fusiform, glabrous, ca. 1 mm long; style 1, 0.2–0.5 mm long, yellowish to brownish; stigmas 2, plumose, 2 mm long. *Fruit* not seen.

Distribution. Endemic to the Eastern Cordillera of Colombia in the Department of Santander; montane forests, on white sandy soils, associated with tree ferns, aralias, and clusias; 1800–1900 m.

Arthrostylidium punctulatum is named for its very spotted (maculate) culms, culm leaves, foliage leaf sheaths, and spikelets. This species is also characterized by culm leaves with the junction between sheath and blade an asymmetrically curved line, extending nearly all the way down along one side of the sheath; branch complement with a nondominant primary central branch; and spikelets 2.5–5 cm long with 2–3 basal glumes and a hispid rachis. This species is most similar to *A. longiflorum* Munro, with which it shares smooth, hollow culms; culm leaves slightly maculate when young with the blade drying rapidly before the sheath; large, striate foliage leaf blades; large spikelets; and paleas smaller than the lemmas and with a pubescent sulcus and ciliate keels.

Subequal branches and a strongly asymmetrical junction of the culm leaf sheath and blade are found in several species of *Rhipidocladum* (Clark & Londoño, 1991). This species, however, lacks the triangular shield and apsidate branching characteristic of *Rhipidocladum*, and thus is most appropriately classified within *Arthrostylidium*.

Paratypes. COLOMBIA. **Santander:** Charalá, Corregimiento Virolín, via Cañaverales-Olival, en inmediaciones del Rio Ruicito, 1850 m, 25 Jun. 1993, *Londoño & Kvist 802* (COL, TULV); via El Reloj-Berlín, aprox. a 2 km de la Escuela Rural El Reloj, 1860 m, 25 jun. 1993, *Londoño & Kvist 807* (COL, TULV).

Arthrostylidium virolinensis Londoño & L. G. Clark, sp. nov. TYPE: Colombia. Depto. Santander: Mpio. Charalá, Corregimineto Virolín, camino a Olival, Vereda Cañaverales, 1800 m, 13 feb. 1983, *S. Diaz-Piedrahita 4048* (holotype, COL). Figure 4.

Bambusa lignosa. Rhizoma sympodiale. Culmi 2–3 m longi, 1–3 mm diam., delicati, scandentes; internodia (1.5–)7–21 cm longa. Folia culmorum 3–6.5 cm longa, erecta, appressa. Ramificatio intravaginalis; rami cujusquisque nodi 10–17, ramus centralis dominans. Vaginae foliorum hispidae, glabrescentes, fimbriatae; laminae foliorum (1–)2.5–3.5(–4.5) cm longae, 0.2–0.45 cm latae, lineari-lanceolatae, glabrae, ad apicem ciliatae. Synflorescentiae ramos terminantes, 1–2 coflorescentibus, spiculae 1–3(–4) multiflorae. Spiculae 1–1.6 cm longae; glumae 2; flosculi fertiles 3–4(–5) et anthoecium rudimentale terminale. Ovarium fusiforme, glabrum, 0.5–1 mm longum; stylus 1; stigmata 2.

Climbing woody bamboo. *Rhizome* short, sympodial. *Culms* 2–3 m long, 1–3 mm diam., delicate, scandent, vining, whiplike, purplish green when young, becoming yellowish green. *Internodes* (1.5–)7–21 cm long, cylindrical, glabrous, tuberculate, solid or with a very small lumen less than 0.2 mm diam. *Bud* one per node, terminal to a slight promontory. *Branching* at mid-culm and upper culm nodes intravaginal; branch complement with 1 or 2 larger branches and 9–15 smaller, secondary branches on a promontory 1–2 mm long, the lowermost branch complement developing adventitious roots at the base. *Culm leaves* 3–6.5 cm long, green when young then stramineous, erect and appressed to culm, the basal ones persistent and rotting in place; *sheaths* 2–4 cm long, 0.45–0.8 cm wide, abaxially hispid, strongly attached at the base to an expanded, darker, retrorsely silky-pubescent flange 1 mm wide, the margins smooth and papery basally, fimbriate at the summit; *fimbriae* few, 1 mm long, curled, readily deciduous; *inner ligule* a horizontal, glabrous, ciliolate membrane 0.2 mm long; *blades* 0.9–2.1 cm long, 0.1–0.2 cm wide, erect, persistent, triangular, acute-mucronate, adaxially puberulous to glabrous, abaxially hispid. *Foliage leaves* 8–12 per complement; *sheaths* hispid, becoming glabrous, striate, the overlapping margin ciliate for the upper ⅓, fimbriate at the summit; *fimbriae* 3–5 mm long, ivory to stramineous, smooth, basally rigid, apically wavy; *inner ligule* 0.1–0.2 mm long, glabrous, ciliolate; *outer ligule* 0.2 mm long, glabrous, stramineous; *pseudopetiole* 0.8–1 mm long, purplish when young becoming yellowish, twisted, hispidulous on both surfaces; *blades* (1–)2.5–3.5(–4.5) cm long, 0.2–0.45 cm wide, linear-lanceolate, glabrous on both surfaces, the apex acute, ciliate, with a tuft of transparent hairs at the tip, adaxially with 2(–3)

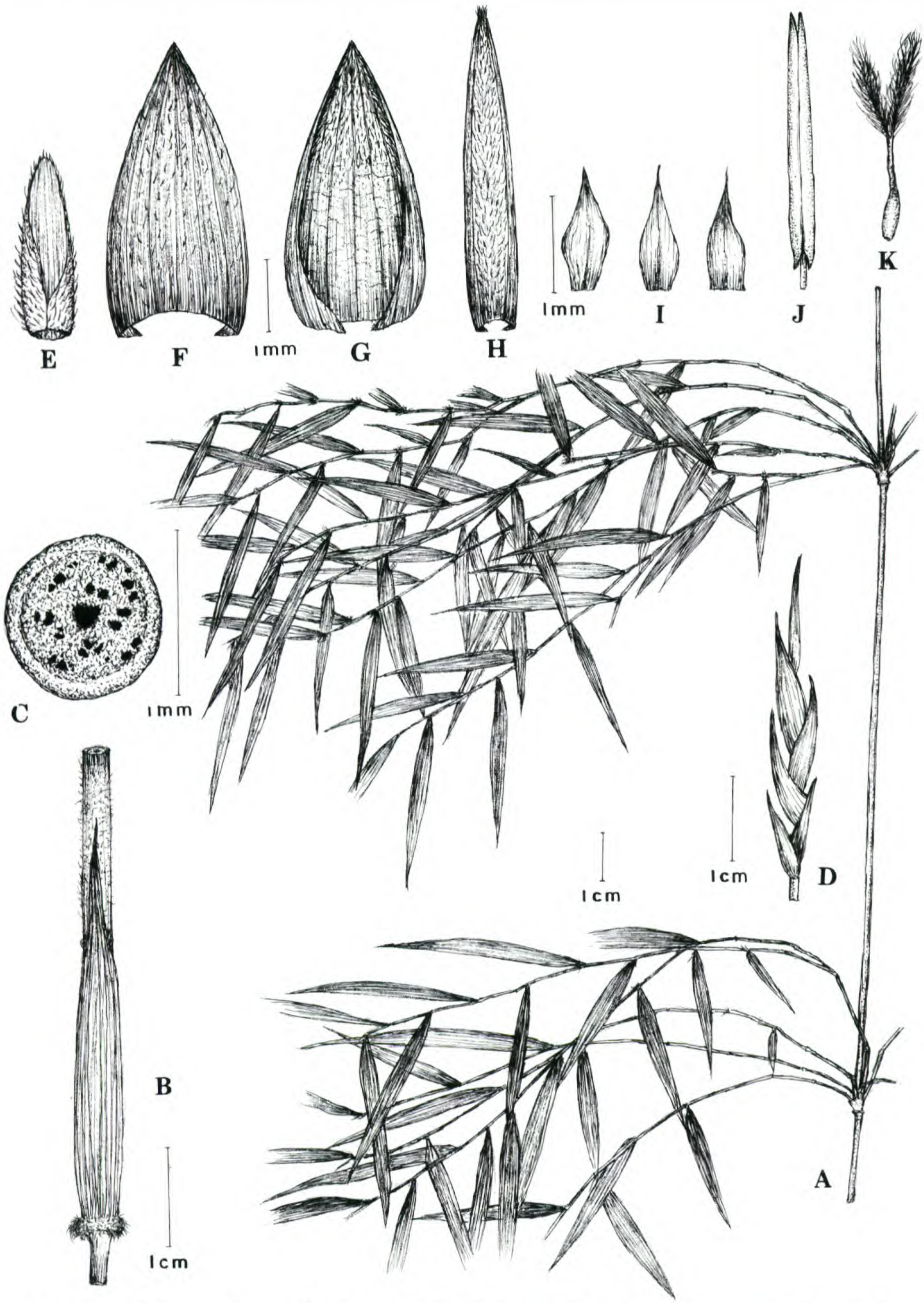


Figure 4. *Arthrostylidium virolinensis* Londoño & L. G. Clark. —A. Branch complement. —B. Culm leaf *in situ*, showing a basal pubescent flange. —C. Cross section of culm showing small lumen. —D. Spikelet. —E. Glume, adaxial view. —F, G. Lemma, abaxial and adaxial views. —H. Palea, adaxial view. —I. Lodicules. —J. Anther. —K. Gynoecium. (A and C based on *Londoño & Kvist 803*; B based on *Londoño & Kvist 823*; D–K based on *Diaz-Piedrahita 4048*.)

raised, scabrid, submarginal nerves on one side, abaxially lighter green except when young with a blue stripe along one margin, the margins scabrous, the midnerve yellowish. *Synflorescences* usually terminating leafy branches of all orders or borne directly from the nodes, consisting of 1–2 cofloresc-ences, these separated by internodes 5–7 mm long. *Coflorescences* 3–4 cm long, each consisting of 1 subtending bract, 1 prophyll, 1 gemmiparous bract, and 1–3(–4) multiflowered spikelets, these separated by internodes 5–7 mm long, the axis hispid, striate, straight to slightly twisted, sulcate above each spikelet, flexuous, bending abruptly 90° above the second spikelet; *subtending bracts* throughout the main axis like a fully developed branch leaf with fimbriae at the summit; *prophyll* 2–3 mm long, 1 mm wide, stramineous, 2-keeled, the keels ciliate and winged; *gemmiparous bract* 1, ca. 5 mm long, 1.5–2 mm wide, 3-nerved, triangular, abaxially hispid, the midnerve strong, the apex covered by hyaline hairs. *Spikelets* 1–1.6 cm long, 1.5–4 mm wide, purple in color, consisting of 2 glumes, 3–4(–5) fertile florets, and a terminal rudimentary anthecium, pedunculate, the peduncle 0.5–0.6 mm long, hispid; *rachis* 1.5–2 mm long, adaxially hispid, abaxially glabrous, disarticulating just below the next lemma; *glumes* 2, unequal, purplish to stramineous, triangular, obtuse, adaxially glabrous except on the upper ⅓ covered by appressed transparent hairs, abaxially hispid, the margins smooth except on the upper ⅓, the midnerve glabrous; *lower glume* 1.5–2.5 mm long, 0.5–0.8 mm wide, 3-nerved; *upper glume* 2.5–3 mm long, 1–1.8 mm wide, 5-nerved; *lemmas* 4–4.5 mm long, 2–2.5 mm wide, equal or shorter than the paleas, 5–6-nerved, ovate-lanceolate, purplish on both surfaces, darker and tessellate adaxially, abaxially hispidulous to glabrous, adaxially glabrous except on the upper ⅓, the apex acute, the overlapping margin ciliolate on the upper ⅓, the midnerve prominent, ending before the tip; *palea* 4.5–5 mm long, 0.5–0.8 mm wide, purplish, the sulcus pubescent otherwise glabrous and shiny, 2-keeled, the keels glabrous, the apex with a tuft of hyaline hairs, the enfolded margins glabrous, shiny, and membranaceous. *Lodicules* 3, 1–1.5 mm long, ca. 0.5 mm wide, lanceolate, acuminate-attenuate, transparent to yellowish, vasculated, with 1–3 distinct brown nerves, the margins smooth. *Stamens* 3, the anthers 2.5–3 mm long, whitish to stramineous. *Ovary* fusiform, glabrous, 0.5–1 mm long, yellowish; style 1, 0.3–0.5 mm long, yellowish to brownish; stigmas 2, 1–1.5 mm long, plumose, whitish to stramineous. *Fruit* not seen.

Distribution. Apparently restricted to the Eastern Cordillera of northeastern Colombia, in the Department of Santander; mossy montane forest edges, associated with aroids, bromeliads, ferns, Piperaceae, and seedling palms; 1800–1900 m.

Arthrostylidium virolinensis is most similar to *A. sarmentosum* Pilger, *A. venezuelae* (Steudel) McClure, and *A. ecuadorense* Judziewicz & L. G. Clark, which share a climbing and scandent habit; delicate, slender culms; small foliage leaf blade size; pubescent and fimbriate foliage leaf sheaths; zig-zag/flexuous synflorescences; and paleas as long as to slightly longer than the lemmas. *Arthrostylidium virolinensis* is sympatric only with *A. venezuelae*, but the overall similarity in habit and synflorescence morphology has led to confusion among these species. The four are compared and contrasted in Table 1. Although zig-zag synflorescences are known in *Rhipidocladum* (Clark & Londoño, 1991), this character may be a synapomorphy for these four species within *Arthrostylidium*.

Arthrostylidium virolinensis is distinguished from the other three species by its obtuse glumes with smooth midnerves, lemmas 4–4.5 mm long, and purplish paleas with glabrous keels (Table 1). Vegetatively, the culm leaves are much shorter than those of *A. sarmentosum* and *A. venezuelae*, whereas the culm leaves of *A. ecuadorense* have reflexed blades. The foliage leaf blades of *A. virolinensis* are the narrowest (0.2–0.45 cm) of any of the species in this group (Table 1). The contrasts between *A. virolinensis* and *A. venezuelae* are evident in foliage leaf length and width, number of spikelets per coflorescence, number of glumes per spikelet, and lemma length (Table 1).

Paratypes. COLOMBIA. **Santander:** Mpio. Charalá, Corregimiento Virolín, via Cañaverales-Olival, en inmediaciones del rio Ruicito, 1820 m, 25 jun. 1993, *Londoño & Kvist 803* (COL, TULV); Mpio. Gambitá, a 1–2 km de Puente Guillermo por la via Charalá-Duitama, 1850 m, 27 jun. 1993, *Londoño & Kvist 823* (COL, TULV).

Rhipidocladum abregoensis Londoño & L. G. Clark, sp. nov. TYPE: Colombia. Norte de Santander: Mun. Abrego, km 20 via Abrego-Jurisdicciones, 1990 m, 18 Abr. 1994 (fl), *X. Londoño, E. Ascanio & S. Rodriguez 881* (holotype, COL; isotypes, ISC, NY, TULV, US). Figure 5.

Bambusa lignosa. Rhizoma sympodiale pachymorphum. Culmi scandentes 4–8 m alti, 1–3(–5) mm diam., cylindrici, cavi; internodiis ad 75 cm longis. Ramuli floriferi 50–100 in quoque nodum, (4.5–)8–21 cm longi. Ramificatio intravaginalis, flabellatis; folia ramulorum (2–)8–15; laminae foliorum planae, lineares, 0.8–2.8(–3.5) × 0.18–0.23 cm, adaxialiter glabrae vel sparsim puberulae, abaxi-

Table 1. Comparison of *Arthrostylidium ecuadorense*, *A. sarmentosum*, *A. venezuelae*, and *A. virolinensis*.

Character	*A. ecuadorense*	*A. sarmentosum*	*A. venezuelae*	*A. virolinensis*
Internode texture	retrorsely scabrid with fragile glossy prickles above	glabrous	glabrous	glabrous
Culm leaf length (cm)	ca. 4.5	7.5–20	15–25	3–6.5
Culm leaf blade position	reflexed	erect	erect	erect
Foliage leaf blade length (cm)	(3.8–)5–10	4–6	7–14.5	(1–)2.5–3.5(–4.5)
Foliage leaf blade width (cm)	0.8–1.3	0.4–0.6	(0.7–)0.9–1.4	0.2–0.45
Number of spikelets per paraclade	3–6	3–5	(4–)5–8	1–3(–4)
Spikelet length (cm)	2.5–4	1.6–1.8	1–1.7(–3)	1–1.6
Number of fertile florets per spikelet	5–9	(2–)4–5	3–4	3–4(–5)
Number of glumes per spikelet	3	2–3	3	2
Glume shape	acute	acute to apiculate	acute, shortly mucronate	obtuse
Glume midnerve pubescence	scabrous	scabrous	scabrous	glabrous
Lemma length (mm)	(6–)8–10(–13)	6–7	(5–)7–10	4–4.5
Palea color	?	yellowish to stramineous with purplish margins	stramineous, occasionally with purplish margins	purplish
Palea keel pubescence	ciliolate	ciliolate	ciliolate	glabrous

aliter glabrae vel breviter pilosae. Synflorescentiae racemiformes, tenues. Spiculae 2–4, 3.3–6 cm longae; glumae 2, aristatae, gluma prima 4.5–6 mm longa, arista 1–1.5 mm longa; secunda 7–9 mm longa, arista 2–3 mm longa; flosculi fertiles 3–5 et anthoecium rudimentale terminale; lemma 12–18 mm longa, 7-nervata, abaxialiter pubescens, arista 4–8 mm longa; paleae 7.2–9 mm longae, breviores quam lemma, carinae 2, purpurea. Ovarium fusiforme, glabrum, ca. 0.7 mm longum; stylus 1; stigmata 2.

Woody bamboo. *Rhizomes* sympodial, short. *Culms* 4–8 m long, 1–3(–5) mm diam., delicate, scandent and clambering. *Internodes* up to 75 cm long, hollow with a small lumen, cylindrical, glabrous, green, maculate with yellowish spots when young becoming all yellow. *Nodal line* expanded into a corky, pubescent, brown, flangelike extension 0.8–1 mm wide; *bud* one per node, positioned 0.5–1 mm above the nodal line. *Branching* intravaginal, with 50–100 subequal branches arising in a fan-shaped or apsidate branch complement; often 1 or 2 branches slightly larger than the others and rebranching. *Culm leaves* erect and appressed to the culm on the lower ⅓ of the culm, deciduous, narrowly triangular; *sheaths* 4–5 cm long, 1–3.5 cm wide, abaxially puberulous, adaxially glabrous, shiny, tessellate, the margins smooth; *inner ligule* a horizontal, truncate membrane 0.2 mm long; *outer ligule* absent; *blades* ca. 1 cm long, erect, deciduous. *Foliage leaves* (2–)8–15 per complement (2–3 on flowering branches); *sheaths* striate, glabrous abaxially, bearing fimbriae at the summit, the overlapping margin densely pilose, the other one pilose; *fimbriae* 4–6 mm long, ivory to stramineous, smooth, basally curved, apically straight to wavy; *inner ligule* 0.2–0.3 mm long, membranaceous, ciliate; *outer ligule* 0.1–0.2 mm long, yellowish, ciliate; *pseudopetiole* 0.8–1 mm long, yellowish to brownish, hispidulous on both surfaces; *blades* 0.8–2.8(–3.5) cm long, 0.18–0.23 cm wide, linear-lanceolate, adaxially glabrous to sparsely puberulent, with 2–3 raised, scabrid, submarginal nerves on one side, abaxially glabrous to short pilose, the midnerve yellowish, manifest basally, the apex acute-mucronate, covered by strigose, transparent hairs, the margins scabrous, becoming ciliate near the apex. *Synflorescences* racemiform, terminating leafy branches of all orders or borne directly from the nodes, (4.5–)8–21 cm long, slightly curved, bearing 2–4(–5) ascending, nonsecund, multiflowered spikelets, these separated by internodes 1–2.6 cm long; *main axis* straight, hispid, densely pubescent at the apex, sulcate above each spikelet. *Spikelets* (including awns) 3.3–6 cm long, 2–3 mm wide, linear-lanceolate, shortly pedunculate, purplish to

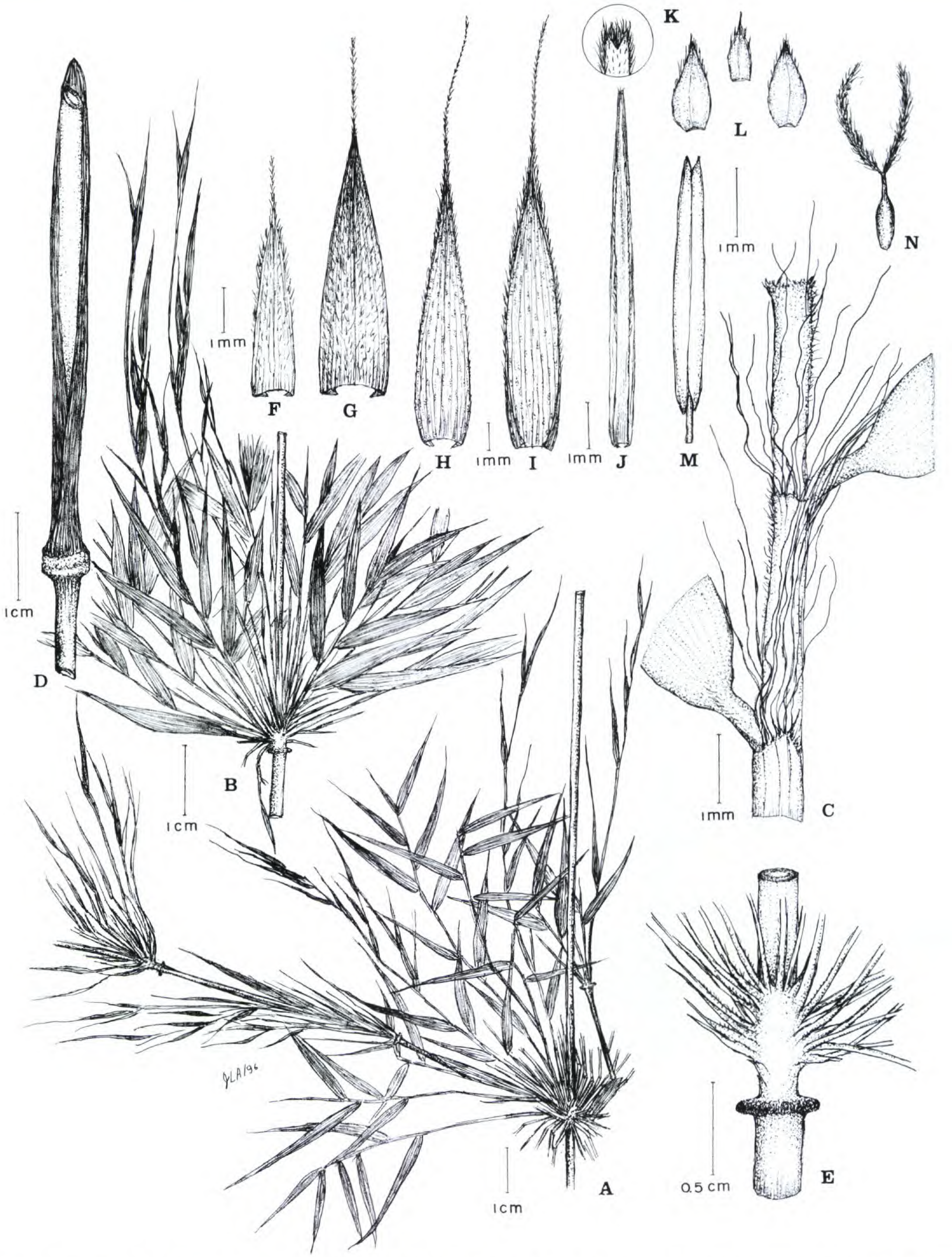


Figure 5. *Rhipidocladum abregoensis* Londoño & L. G. Clark. —A, B. Flowering branch complements. —C. Foliage leaf blade, ligular area. —D. Culm leaf *in situ*. —E. Culm node with branch complement. —F, G. Glumes, abaxial views. —H, I. Lemma, abaxial and adaxial views. —J. Palea, adaxial view. —K. Apex of palea showing ciliate margins and tuft of hairs at the bifid tip. —L. Lodicules. —M. Anther. —N. Gynoecium. (A–N based on *Londoño et al. 881*.)

Table 2. Comparison of *R. abregoensis*, *R. panamense*, and *R. sibilans*.

Character	*R. abregoensis*	*R. panamense*	*R. sibilans*
Culm diameter (cm)	0.1–0.3(–0.5)	0.5–0.7	to 1.5
Culm leaf blade apex	acute	?	long acuminate
Nodal flange	present	absent	absent
Number of branches per node	50–100	200–230	150–200
Foliage leaf shealth fimbriae length (mm)	4–6	ca. 2	1–3
Foliage leaf blade length (cm)	0.8–2.8(–3.5)	3–6	5–7
Foliage leaf blade width (cm)	0.18–0.23	0.2–0.3	0.18–0.27(–0.35)
Adaxial foliage leaf blade pubescence	glabrous	pubescent with strigose transparent hairs	glabrous
Number of strong marginal nerves on the blade	2–3	1	1(–2)
Number of spikelets per paraclade	2–4(–5)	5–7	2–3
Spikelet length (mm)	3.3–6	1.2–1.6	2–4
Number of fertile florets per spikelet	3–5	2	2–3
Number of glumes per spikelet	2	3	4–5
Adaxial glume pubescence	glabrous	pubescent toward the apex	?
Lemma body length (mm)	9–10	5.5–6	ca. 10
Palea color	purplish	yellowish to stramineous	?
Palea keels	not winged	winged	winged

stramineous mottled with dark green spots, consisting of 2 glumes, 3–5 fertile florets, and a terminal rudimentary anthecium, the peduncle 0.3–0.5 mm long, pubescent; *rachis* between glumes 0.5–0.7 mm long, between florets 5–7 mm long, smooth, with dark green spots on the upper ⅓, disarticulating just below the next lemma; *glumes* 2, unequal; awned, stramineous, adaxially glabrous, abaxially pubescent, the awn scabrous, the margins ciliolate on the upper ⅓; *lower glume* 4.5–6 mm long, 0.7–1.5 mm wide, linear-lanceolate to lanceolate, the midnerve prominent, asymmetrical, and brownish, the awn 1–1.5 mm long; *upper glume* 7–9 mm long, 1.2–2 mm wide (including awn), 7-nerved, linear-lanceolate, the awn 2–3 mm long; *lemmas* 12–18 mm long, 2–2.2 mm wide, 7-nerved, linear-lanceolate, awned, light purplish to stramineous mottled with darker spots, adaxially glabrous and tessellate, abaxially pubescent, the margins ciliolate except on the lower ⅓, the awn 4–8 mm long, scabrous; *palea* 7.2–9 mm long, 0.3–0.6 mm wide, smaller than the lemma, purplish, 2-keeled, the keels minutely ciliolate except on the lower ⅓, the sulcus puberulent, the enfolded margins glabrous, 3-nerved, papery and shiny toward the margins. *Lodicules* 3, narrowly ovate, acuminate, glabrous, transparent, membranaceous, vasculated, ciliolate on the margins, the posterior one 0.8 mm long, the anterior pair 1.2–1.5 mm long. *Stamens* 3, the anthers 3.8–4.5 mm long, yellowish to stramineous, linear. *Ovary* fusiform, glabrous, ca. 0.7 mm long, yellowish; style 1, 0.3 mm long, lighter than the ovary; stigmas 2, plumose, 2 mm long. *Fruit* not seen.

Distribution. Endemic to the Eastern Cordillera of Colombia; deforested areas along the road; ca. 1990 m.

Rhipidocladum abregoensis is named for its type locality, where a number of bamboos occur, including the recently discovered *Otatea* and several species of *Chusquea*. This new species is classified as a member of *Rhipidocladum* sect. *Racemiflorum* L. G. Clark & Londoño because of its smaller size, scandent and clambering habit, and aristate glumes (Clark & Londoño, 1991). Its very sparsely flowered, nonunilateral arrangement of spikelets in the synflorescence, slender, terete, awned spikelets, and mottled lemmas are unusual in *Rhipidocladum* (Judziewicz et al., 1991). These features are shared with *R. panamense* R. W. Pohl and *R. sibilans* Davidse, Judziewicz & L. G. Clark, species with which the new species is compared and contrasted (Table 2). These three species also share very narrow foliage leaf blades. As far as is known, these species are not sympatric, but they may form a group within the genus based on their morphological similarities.

According to its original description (Pohl, 1985), *R. panamense* has unilateral synflorescences. In all the specimens of this species exam-

ined at US, this species has nonunilateral synflorescences with spikelets borne 5–20 mm apart.

Rhipidocladum abregoensis is distinguished by the presence of a nodal flange (Fig. 5E); rebranching of a few of the secondary branches per complement (Fig. 5A); well-developed fimbriae on the foliage leaf sheath summits; foliage leaf blades with 2–3 strong marginal nerves; spikelets 3.3–6 cm long; two glumes per spikelet; purplish paleas; and unwinged palea keels (Table 2). *Rhipidocladum abregoensis* is similar to *R. panamense* based on its slender culms, but has fewer branches per node, shorter foliage leaf blades with 2–3 strong marginal nerves, fewer spikelets per synflorescence, fewer florets per spikelet, adaxially glabrous glumes, and lemmas 9–10 mm long (Table 2), in addition to the distinguishing features listed above. *Rhipidocladum abregoensis* is easily distinguished from *R. sibilans* by its smaller culms, acute culm leaf blades, shorter foliage leaf blades, and two glumes per spikelet (Table 2).

The one or two slightly larger, rebranching secondary branches (Fig. 5A) noted in this species are unique in the genus. All other species of *Rhipidocladum* produce few to many subequal, determinate, secondary branches per node; if these branches rebranch at all, it is from the base to produce another slender leafy branch (Clark & Londoño, 1991). Because *R. abregoensis* is known from only one specimen, additional collections must be observed to determine whether this branching pattern is indeed characteristic of the species. This pattern is also found in three species of *Merostachys* (Sendulsky, 1997), another genus in which the secondary branches typically do not rebranch.

Guadua angustifolia Kunth var. **nigra** Londoño, var. nov. TYPE: Colombia. Quindio: Mpio. Montenegro, ca. 10 km W of Montenegro, 1200 m, 11 mar. 1996, *X. Londoño 960* (holotype, COL; isotypes, HUQ, TULV, US).

Guaduae angustifoliae var. *angustifoliae* affinis, a qua imprimis differt culmo ater.

Woody, thorny bamboo. *Rhizomes* pachymorph. *Culms* 10–20 m tall, 8–12 cm diam., stiffly arched. *Internodes* 13–30 cm long, hollow, green when young, showing dark spots during maturation and turning black with age. *Nodes* solitary, a band of appressed white hairs above and below the nodal line; bud solitary. *Culm leaves* coriaceous, deciduous, triangular; *sheaths* 35–45 cm long, 25–30 cm wide, abaxially strigose, adaxially glabrous and shiny; *blades* 9–12 cm long, 6–8 cm wide, erect, persistent, mucronate at the apex, adaxially conspicuously nerved and pubescent between the nerves; *inner ligule* 0.8–1 mm long, ciliolate along the margin; *outer ligule* absent. *Branching* intravaginal; primary branch solitary and armed. *Foliage leaves* 7–9 per complement; *sheaths* glabrous to glabrescent, nonauriculate, bearing fimbriae at the summit; *blades* 10–22 cm long, 0.5–2 cm wide, mostly glabrous on both surfaces, but with sparse, hyaline hairs.

Guadua angustifolia var. *nigra* is known only from the type locality, where it grows in a very restricted area at the edge of a creek. It was first discovered by Ever Betancurt, a horticulturally skilled local inhabitant who has devoted his life to the management of guaduales in this region.

Chusquea antioquensis L. G. Clark & Londoño, sp. nov. TYPE: Colombia. Antioquia: Mun. La Unión, Río Buey, 5.6 km SW of Mesopotamia and 25 km NE of Abejorral, 5°53′N, 75°20′W, 2220 m, 18 June 1994 (fl), *L. G. Clark, X. Londoño & N. Giraldo 1232* (holotype, HUA; isotypes, COL, ISC, TULV, US). Figure 6.

Culmi (4–)6–12(–15) m alti, 1.3–5.5 cm diam., erecti ad basim, arcuati et scandentes apicem versus. Internodia 25–42 cm longa ad basim, solida, leviter sulcata. Folia culmorum 38–65 cm longa, triangulares, nodum proximum superantia, persistentes; vaginae 20.5–45.5 cm longae, 1.2–3.5(–4.2)-plo longiores quam laminam, abaxialiter pubescentes vel scabrosae ad basim, scabridae vel glabrae ad apicem; cingulum (1–)3–10 mm latum, pubescenti-hirsutum; laminae 9.7–21 cm longae, erectae, apice setosi-acuminatae vel subulatae. Ramificatio infravaginalis; rami subsidiarii cujusquisque nodi 50–100, 17–45 cm longi. Folia cujusquisque complementi 4–7; vaginae glabrae, apice utrinque leviter prolongatae, adnatae ad ligulam interiorem; laminae 17–26.5 cm longae, 0.3–0.7 cm latae, long./lat. = 31–55(–65), apice setosae, basi attenuatae. Synflorescentia 13.5–19 cm longa, paniculata, angusta. Spiculae (7.9–)8.6–10(–11) mm longae; glumae I et II 0.5–0.7 mm longae, obtusae; gluma III 5.3–6.2 mm longa, ½–⅔ longior quam spiculam, breviter aristata; gluma IV 6.2–7.1 mm longa, ca. ⅘ longior quam spiculam, breviter aristata; lemma 7.6–7.9 mm longum, breviter aristatum; palea 7.3–7.6 mm longa.

Woody bamboo. *Culms* (4–)6–12(–15) m tall, 1.3–5.5 cm diam., erect at base, arching above and sometimes scandent in trees. *Internodes* 25–42 cm long in the lower ⅓ of culm, solid, scabrous just below the node and otherwise glabrous or completely glabrous, shallowly sulcate above the bud/branch complement. *Culm leaves* 38–65 cm long, triangular, usually persistent, usually surpassing the next node, the juncture of the sheath and blade abaxially obscure but somewhat acute; *sheaths* 20.5–45.5 cm long, 1.2–3.5(–4.2) times as long as the blade, abaxially pubescent or retrorsely scabrous at the

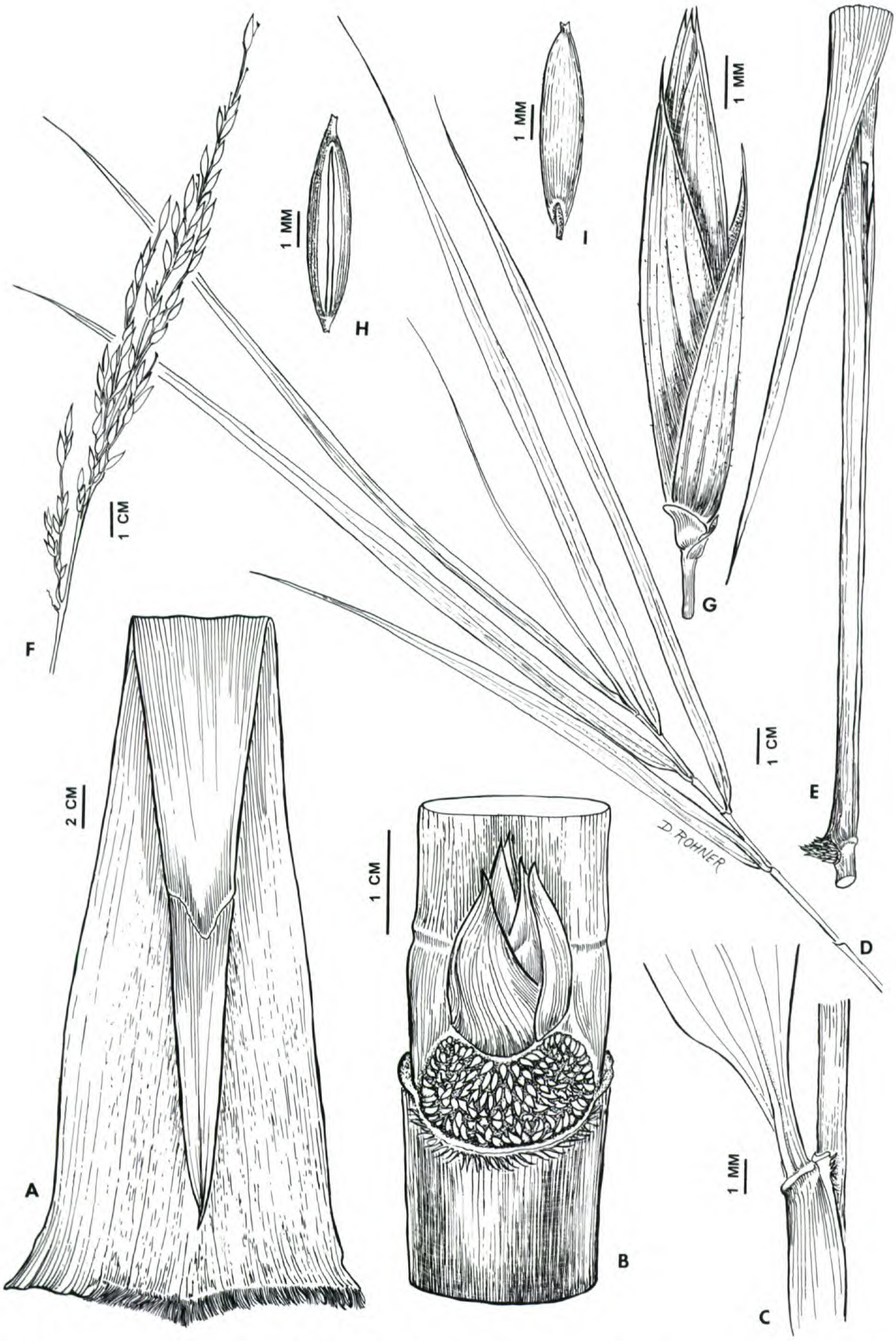


Figure 6. *Chusquea antioquensis* L. G. Clark & Londoño. —A. Culm leaf. —B. Bud complement. —C. Foliage leaf, ligular area. —D. Leaf complement. —E. Culm leaf *in situ*, with emerging branches. —F. Synflorescence. —G. Spikelet. —H, I. Caryopsis, hilum and embryo views. (A, B based on *Clark & Londoño 1222*; C, D based on *Clark & Londoño 1219*; E based on *Calderón et al. 2988*; F, I based on *Clark et al. 1232*.)

base, becoming scabrid or glabrous toward the summit, no midrib distinguishable, the overlapping margin sparsely ciliate along most of its length; *girdle* (1–)3–10 mm wide, densely pubescent-hirsute; *inner ligule* 1–2.5 mm long, slightly irregular, completely ciliate or ciliate only toward each margin; *blades* 9.7–21 cm long, nearly strap-shaped, erect, persistent, abaxially retrorsely scabrous, apex setose-acuminate to shortly subulate. *Nodes* at mid-culm with one triangular central bud subtended by numerous subsidiary buds in several rows in constellate arrangement; nodal line horizontal, dipping markedly below the bud/branch complement; supranodal ridge evident about 7–11 mm above the nodal line. *Branching* infravaginal; central branch often developing at mid-culm and higher nodes; leafy subsidiary branches 50–100 per node, 17–45 cm long, usually not rebranching. *Foliage leaves* 4–7 per complement; *sheaths* striate, glabrous, ± keeled, the summit slightly prolonged on each side and adnate to the inner ligule, occasionally sparsely ciliate, the overlapping margin ciliate; outer ligule 0.3–0.5 mm long, glabrous; inner ligule 0.5–1.2(–1.7) mm long, rounded or irregular, abaxially pubescent; pseudopetiole 2–3 mm long; *blades* 17–26.5 cm long, 0.3–0.7 cm wide, L:W = 31–55(–65), linear-lanceolate, adaxially retrorsely scabrid, not tessellate, abaxially glabrous, not tessellate or weakly so, the midrib ± prominent abaxially, the apex shortly setose to setose, the base attenuate, the margins somewhat prominent, 0.1–0.2 mm wide, cartilaginous, serrulate. *Synflorescences* 13.5–19 cm long, paniculate, narrow; main axis angular, ridged, scabrid, subtended by a small, obtuse bract 1.5–2 mm long but a subtending spathe absent; axes of paraclades angular, scabrid, appressed; peduncles 1.5–5(–9) mm long. *Spikelets* (7.9–)8.6–10(–11) mm long; *glumes* I and II 0.5–0.7 mm long, scalelike, glabrous, obtuse, 1-nerved; glume I no more than $\frac{1}{20}$ the spikelet length; glume II ca. $\frac{1}{10}$ the spikelet length; *glumes* III and IV triangular, slightly navicular, shortly aristate, abaxially scabrid between the nerves on the upper ½; glume III 5.3–6.2 mm long, ½–⅔ the spikelet length, 7-nerved; glume IV 6.2–7.1 mm long, ca. $\frac{1}{5}$ the spikelet length, 9-nerved; *lemma* 7.6–7.9 mm long, triangular, slightly navicular, shortly aristate, abaxially scabrid between the nerves on the upper ½, 9-nerved; *palea* 7.3–7.6 mm long, navicular, abaxially scabrid, sulcate, 2-keeled, 6-nerved. *Lodicules* 3, densely ciliate abaxially and on the margin; the anterior pair ca. 1.1 mm long; the posterior one ca. 0.9 mm long. *Stamens* not seen. *Ovary* not seen. *Fruit* a caryopsis, ca. 4.8 mm long, reddish brown; hilum linear, reddish brown but the area around it golden-brown; embryo small.

Distribution. Central Cordillera of Colombia in Antioquia and Caldas; montane forest, persisting in disturbed areas; 2050–2340 m.

This striking species is characterized by its shallowly sulcate internodes; large triangular culm leaves with densely pubescent girdles; infravaginal branching with the central branch frequently developing at mid-culm or higher nodes; numerous subsidiary branches; narrow foliage leaf blades with L:W = 31–55(–65) and setose apices; narrowly paniculate synflorescences; and spikelets (7.9–)8.6–10(–11) mm long with glumes III and IV and the lemma shortly aristate. The infravaginal branching, numerous constellate subsidiary buds/branches, narrow foliage leaf blades, scalelike glumes I and II, and shortly aristate glumes III and IV and the lemmas are characters shared with other members of *Chusquea* sect. *Longifoliae* L. G. Clark (Clark, 1989) within which *C. antioquensis* is placed. The best developed plants of this species reach 5.5 cm in diameter and upward of 15 m in length, making this one of the largest species in the genus.

The type specimen is the only known collection of this species in flower. Several clumps in the area were blooming, but one nearby clump was vegetative with new shoots. Other collections of this species (*Clark et al. 1219, 1222*) made at the same time were vegetative, indicating that this was not a gregarious blooming event. Copious fruits were produced, and a few seedlings were observed growing near the plant from which specimens were taken.

Paratypes. COLOMBIA. **Antioquia:** Mun. La Unión, Abejorral-Mesopotamia-Sonsón road, Río Buey crossing, along both banks, 2260 m, 5°52′N, 75°20′W, 28 Feb. 1988, *Clark & Londoño 426* (COL, ISC, TULV, US); Mun. San Vicente, road between San Vicente and Concepción, 12.6 km SW of Concepción, Q. El Cabullo, 2110 m, 6°20′N, 75°17′W, 14 June 1994, *Clark, Londoño & Giraldo 1219* (COL, ISC, TULV, US); Mun. Concepción, road from Concepción to Barbosa, 7.5 km NW of Concepción, 2230 m, 6°25′N, 75°17′W, 14 June 1994, *Clark, Londoño & Giraldo 1222* (COL, ISC, TULV, US). **Caldas:** Manizales, La Bocatoma, 6 Aug. 1981, *Calderón, Clark & Pohl 2988* (ISC, US); Manizales, La Bocatoma SE of Manizales, 2050 m, 10 Feb. 1982, *Clark, Clark, Manzur & Londoño 255* (COL, ISC, US); Mun. Villamaria, 15.5 km below Hotel Los Termales del Ruiz, opposite entrance to Termales El Otoño, 5°02′N, 75°27′W, 2340 m, 27 Jan. 1988, *Clark & Londoño 372* (COL, ISC, TULV, US).

Chusquea arachniforme L. G. Clark & Londoño, sp. nov. TYPE: Colombia. Antioquia: Mun. Amalfí, Vereda El Guayabito, kms 3–6 de la via Amalfí-El Guayabito, NE de Amalfí, sitio Tabanito, 6°54′N, 75°01′O, 1650 m, 5 dic. 1989 (fl), *R. Callejas, J. Betancur & O. D. Escobar 8994* (holotype, HUA; isotypes, COL?, MO). Figure 7.

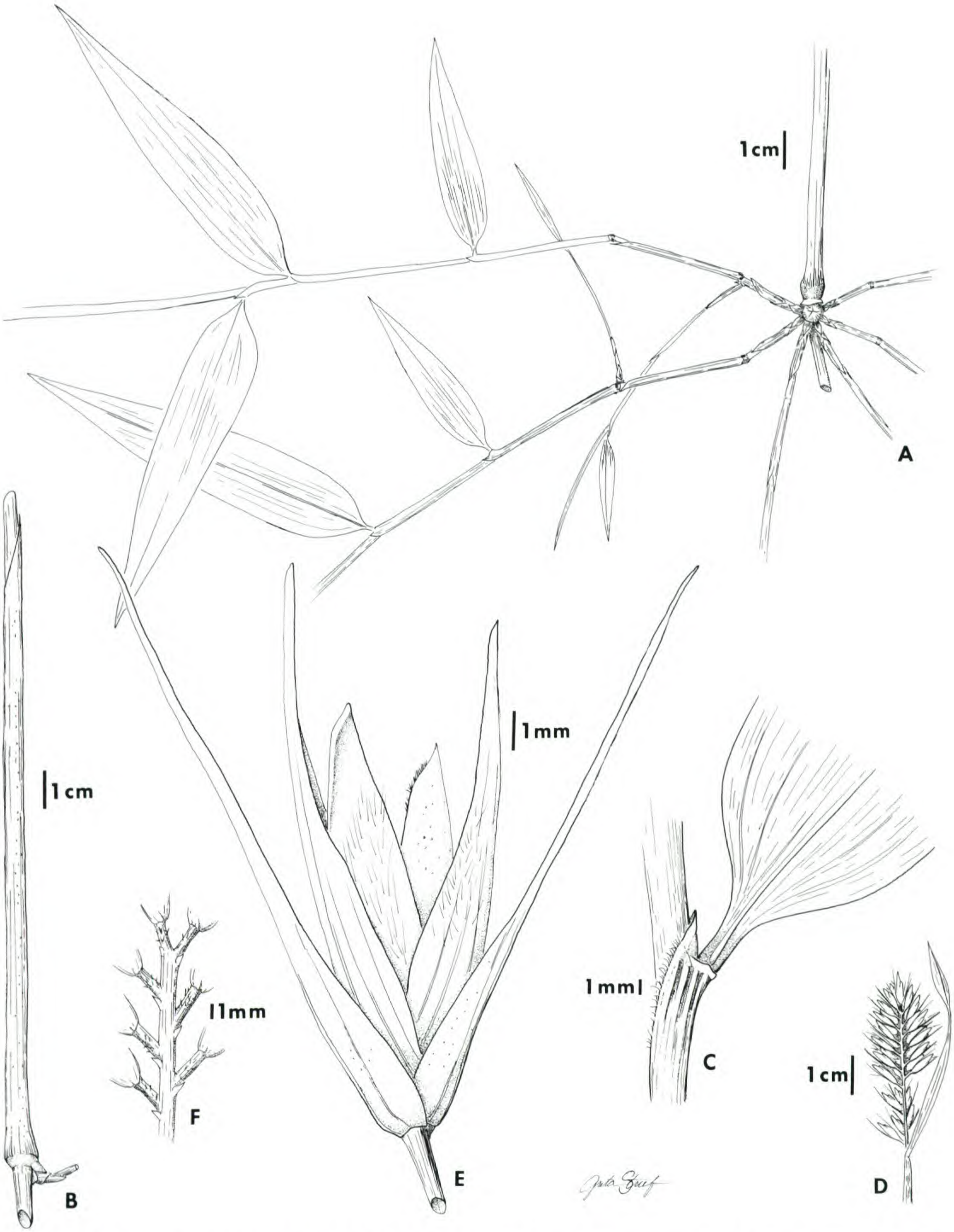


Figure 7. *Chusquea arachniforme* L. G. Clark & Londoño. —A. Branch complement with foliage leaves. —B. Culm leaf *in situ*. —C. Foliage leaf, ligular area. —D. Synflorescence with subtending spathe. —E. Spikelet. —F. Detail of subtending bracts in apical portion of synflorescence. (A–C based on *Clark et al. 1228*; D–F based on *Callejas et al. 8994*.)

Culmi 2–3 m longi, 0.3–0.5 cm diam., scandentes. Internodia 20–28 cm longa, glabra. Folia culmorum 9.4–16.7(–29.3) cm longa, persistentia; vaginae 9–26.5 cm longae, (9.5–)13–26(–47)-plo longior quam laminam, abaxialiter retrorsum scabrae; cingulum 2–5(–10) mm latum, glabrum; laminae 0.3–2.8 cm longae, erectae, persistentes, adaxialiter pubescentes, abaxialiter glabrae. Ramificatio infravaginalis; rami subsidiarii cujusquisque nodi 5–7, usque ad 20 cm longi, geniculati. Folia cujusquisque complementi 3–6; vaginae glabrae; laminae 9–14 cm longae, 1.6–2.5 cm latae, long./lat. = 5–7.8, glabrae, basi asymmetricae. Synflorescentia 2–4 cm longa, ca. 1.5 cm lata, capitata, congesta, plerumque interrupta, spatha singularis subtenta. Spiculae aristis inclusis 11.8–19.5 mm longae, 10.5–11.5 mm longae sine aristis; gluma I 12–20 mm longa, 1.1–1.7-plo longior quam lemma, aristata; gluma II 10.2–17.6 mm longa, 1.1–1.5-plo longior quam lemma, aristata; gluma III 11.4–15.7 mm longa, 1.1–1.4-plo longior quam lemma; gluma IV 10.9–13 mm longa, 1–1.1-plo longior quam lemma, obtusata; lemma 9.8–10.7 mm longum; palea 8.6–9.8 mm longa, glabra.

Woody bamboo. *Culms* 2–3 m long, 0.3–0.5 cm diam., scandent and climbing. *Internodes* 20–28 cm long, terete, glabrous. *Culm leaves* 9.4–16.7(–29.3) cm long, ± persistent, juncture of sheath and blade abaxially obscure; *sheaths* 9–26.5 cm long, (9.5–)13–26(–47) times longer the blade, adaxially glabrous and shiny below, pubescent near the summit, abaxially retrorsely scabrous, the midrib manifest near the summit, the overlapping margin ciliate for most of its length, fused to sheath just at the base; *girdle* 2–5(–10) mm long, to 1 cm long over the bud complement; *inner ligule* ca. 0.5 mm long, erose; *blades* 0.3–2.8 cm long, erect, persistent, adaxially pubescent, abaxially the midrib raised and prominent, apex shortly subulate, the margins glabrous. *Nodes* at mid-culm slightly swollen, with one circular central bud subtended by 5 or 6 smaller subsidiary buds in a constellate arrangement; nodal line horizontal, dipping markedly below the bud/branch complement; supranodal ridge ± prominent. *Branching* infravaginal; leafy subsidiary branches 5–7 per node, to ca. 20 cm long without synflorescences, geniculate, rebranching at the lower nodes. *Foliage leaves* 3–6 per complement; *sheaths* striate, glabrous, keeled toward the summit, the margins slightly scarious toward the summit, the overlapping one ciliate for the upper ⅔ of its length; outer ligule 0.5–0.6 mm long, bilobed, glabrous; inner ligule 1.5–3.5 mm long, asymmetrical, glabrous; pseudopetiole 3–4 mm long; *blades* 9–14 cm long, 1.6–2.5 cm wide, L:W = 5–7.8, ovate-lanceolate, glabrous, not tessellate, the base slightly asymmetrical, one side rounded, the other rounded-attenuate, the apex attenuate, the margins thin, finely serrulate. *Synflorescence* 2–4 cm long, ca. 1.5 cm wide, capitate, congested, often interrupted at the base, subtended by a single spathe, the spathe with the sheaths 2.3–3.8 cm long, slightly expanded, the blades 1.5–2.2 cm long, green, deciduous; main axis angular, slightly sinuous, pubescent toward the base; axes of the paraclades angular, pubescent, the edges ciliate, the primary paraclades bracteate, the subtending bracts 1.5–3 mm long at the lowermost paraclades, ca. 0.3 mm at the apical paraclades, the lowermost primary paraclades 0.5–1 cm long; peduncles 1–3 mm long. *Spikelets* 11.8–19.5 mm long including the awns, the body 10.5–11.5 mm long, laterally compressed; *glumes* I and II triangular, tapering, awned, keeled, abaxially shortly pubescent-scabrous, the awns scabrous; glume I 12–20 mm long including the awn, 1.1–1.7 times the length of the lemma, 3-nerved, the body 3.5–4 mm long, the awn 8.5–16 mm long; glume II 10.2–17.6 mm long, 1.1–1.5 times the length of the lemma, 5-nerved, the body 4–4.5 mm long, the awn 6.2–13.1 mm long; *glumes* III and IV ± navicular, abaxially pubescent-scabrous on the upper ⅓; glume III 11.4–15.7 mm long including the awn, 1.1–1.4 times the length of the lemma, keeled, 9-nerved, the body 9–11.7 mm long, the awn 2.4–4 mm long; glume IV 10.9–13 mm long, 1–1.1 times the length of the lemma, the apex ± blunt, unawned, 7-nerved; *lemma* 9.8–10.7 mm long, ± triangular, navicular, the apex keeled, fused for a short distance, unawned, abaxially the upper ½ with long appressed hairs, 7-nerved; *palea* 8.6–9.8 mm long, navicular, biapiculate, glabrous, sulcate only at the apex, 4-nerved. *Lodicules* 3, ciliate; the anterior pair 2–2.5 mm long, tapering; the posterior one 1.5–2.3 mm long. *Stamens* 3; anthers ca. 6 mm long. *Ovary* not seen. *Fruit* not seen.

Distribution. Endemic to the northern extreme of the Central Cordillera of Colombia, only in Mun. Amalfi of the Department of Antioquia; disturbed sites in montane forest; 1650–1900 m.

Chusquea arachniforme is named for its geniculate branches that fan out from the node like the legs of a spider (Fig. 7A). This species is distinguished by its climbing habit; culm leaf blades with an abaxially prominent midrib; infravaginal branching; relatively few (5–7), geniculate subsidiary branches per node; rebranching of the subsidiary branches from their lower nodes; relatively wide foliage leaf blades with L:W = 5–7.8; interrupted capitate synflorescences subtended by a single spathe; glumes I and II with well-developed awns; and lemmas with long appressed hairs. The flowering event in 1989 was evidently a gregarious one, as the Sitio Tabanito population we observed in 1994 consisted entirely of juvenile plants of approximately the same age that had not yet achieved

the mature diameter of the culms seen in the flowering specimens.

This species is classified within *Chusquea* subg. *Rettbergia* (Raddi) L. G. Clark with which it shares a climbing habit, abaxially scabrous culm leaves with an abaxially prominent midrib on the blade, infravaginal branching, relatively few branches per node, a circular central bud, and a spatheate synflorescence (Clark, 1997). Sequence data from the *rpl16* intron strongly support the placement of this species, which was designated as *Chusquea* sp. A, in the Rettbergia clade within *Chusquea* (Kelchner & Clark, 1997). *Chusquea* subg. *Rettbergia* is primarily distributed in the Atlantic forests of Brazil; *C. barbata* L. G. Clark from Peru (Clark, 1993) and *C. arachniforme* from Colombia are widely disjunct from the rest of this subgenus.

The development of the awns on glumes I and II in *C. arachniforme*, especially on spikelets terminating the main axis or primary paracladia, is remarkable and matched within the genus only by *C. bahiana* L. G. Clark, *C. bradei* L. G. Clark, and *C. urelytra* Hack., also members of *Chusquea* subg. *Rettbergia* but from Brazil (Clark, 1996). The general morphology of the spikelet in *C. arachniforme* is similar to that of *C. bahiana*, but the long hairs on glume IV and the lemma are like those in the spikelets of *C. barbata* and *C. bradei*.

Paratypes. COLOMBIA. **Antioquia:** Mun. Amalfi, about 3 km S of Amalfi on the road to Vereda El Guayabito, old road, 6°52′N, 75°05′W, 1760 m, 15 June 1994, *Clark, Londoño & Giraldo 1227* (COL, HUA, ISC, TULV, US); Mun. Amalfi, 5.7 km S of Amalfi on the road to El Guayabito, sitio El Tabanito, 6°52′N, 75°05′W, 1900 m, 15 June 1994, *Clark, Londoño & Giraldo 1228* (COL, HUA, ISC, TULV, US).

Acknowledgments. Fieldwork by the authors in 1994 was supported by National Science Foundation Grant DEB-9218657 to LGC, and conducted under the auspices of INCIVA. Londoño thanks INCIVA and L. P. Kvist for support for fieldwork in the area of Virolín. The Corporación Regional del Norte de Santander (CORPONOR), Seccional Ocaña, and its functionaries Emilio Ascanio and Silfrido Rodriguez (deceased), provided special assistance in Abrego. Armando Amaya and Jelsy Jácome provided logistical support for the collection of *Otatea*. The fine illustrations were prepared by Jairo Larrahondo (Figs. 1–5), Dorothea Rohner (Fig. 6), and Greta Strief (Fig. 7).

Literature Cited

Clark, L. G. 1989. Systematics of *Chusquea* Section *Swallenochloa*, Section *Verticillatae*, Section *Serpentes*, and Section *Longifoliae* (Poaceae–Bambusoideae). Syst. Bot. Monogr. 27: 1–127.

———. 1993. Five new species of *Chusquea* (Poaceae: Bambusoideae) and a new combination. Novon 3: 228–238.

———. 1995. Diversity and distribution of the Andean woody bamboos (Poaceae: Bambuseae). Pp. 501–512 *in* S. P. Churchill et al. (editors), Biodiversity and Conservation of Neotropical Montane Forests. The New York Botanical Garden, Bronx.

———. 1996. Four new species of *Chusquea* (Poaceae: Bambusoideae) from Brazil and Ecuador. Brittonia 48: 250–262.

———. 1997. Diversity, biogeography, and evolution of *Chusquea* (Poaceae: Bambusoideae). Pp. 33–44 *in* G. P. Chapman (editor), The Bamboos. Academic Press, London.

——— & X. Londoño. 1991. A new species and new sections of *Rhipidocladum* (Poaceae: Bambusoideae). Amer. J. Bot. 78: 1260–1279.

Estrada, J. & J. Fuertes. 1993. Estudios botánicos en la Guayana colombiana, IV. Notas sobre la vegetación y la flora de la Sierra de Chiribiquete. Rev. Acad. Col. Ciencias 18: 483–498.

Judziewicz, E. J. & L. G. Clark. 1993. A revision of the South American species of *Arthrostylidium* (Poaceae: Bambusoideae). Syst. Bot. 18: 80–99.

———, G. Davidse & L. G. Clark. 1991. Six new bamboos from the Venezuelan Guayana. Novon 1: 76–87.

———, L. G. Clark, X. Londoño & M. J. Stern. In press. The American Bamboos. Smithsonian Institution Press, Washington, D.C.

Kelchner, S. A. & L. G. Clark. 1997. Molecular evolution and phylogenetic utility of the chloroplast *rpl16* intron in *Chusquea* and the Bambusoideae (Poaceae). Molec. Phylog. Evol. 8: 385–397.

Londoño, X. 1990. Aspectos sobre la distribución y la ecología de los bambues de Colombia (Poaceae: Bambusoideae). Caldasia 16: 139–153.

Pohl, R. W. 1985. Three new species of *Rhipidocladum* from Mesoamerica. Ann. Missouri Bot. Gard. 72: 272–276.

Sanchez Paez, H., J. I. Hernandez C., J. V. Rodriguez M. & C. Castaño U. 1990. Nuevos Parques Nacionales de Colombia. Instituto Nacional de Los Recursos Naturales Renovables y del Ambiente–INDERENA, Bogotá.

Sendulsky, T. 1997. Twelve new species of *Merostachys* (Poaceae: Bambusoideae: Bambuseae) from Brazil. Novon 7: 285–307.

Stapleton, C. M. A. 1997. The morphology of the woody bamboos. Pp. 251–267 *in* G. P. Chapman (editor), The Bamboos. Academic Press, London.

Salpinctes (Apocynaceae) is a Synonym of *Mandevilla*

J. Francisco Morales
Instituto Nacional de Biodiversidad (INBio), Apto. 22-3100, Santo Domingo de Heredia, Costa Rica

ABSTRACT. The monotypic genus *Salpinctes* is reduced to synonymy of *Mandevilla*. A new combination is proposed here.

The genus *Salpinctes* was described by Woodson in 1931. It was characterized by its eglandular and coriaceous leaves, uniflorous inflorescences, geminate disk glands, and suffrutescent habit (Woodson, 1931). Woodson described two species, *S. duidae* and *S. kalmiaefolius*, both restricted to the dry Savanna Hills in Guyana and each known only from the type collections.

In the original description, Woodson related this genus to *Echites*, *Stipecoma*, and *Macropharynx*, although *Salpinctes* (according to Woodson's criteria) clearly differs from these genera by its leaves never peltate, and sepals with numerous colleters (Woodson's "squamellae") within. He also related this genus to *Dipladenia* (later included in *Mandevilla*), from which it was distinguished by the inflorescence structure and the form of the pistil head.

In his monograph of the subfamily Apocynoideae (Echitoideae), Woodson (1936) mentioned that the status of the genus *Salpinctes* was unclear due to the few specimens or other data known about it. Later, flowering specimens of *Salpinctes duidae* (originally described only with fruits) showed its affinity with *Mandevilla*, whereupon Woodson (1953) transferred it to *Mandevilla*.

As mentioned by Woodson, *Dipladenia* was formerly considered distinct from *Mandevilla* on the basis of geminate disk glands; however, the discovery of many intergradations in this and other characters forced him to include *Dipladenia* in the synonymy of *Mandevilla*. Most species of *Mandevilla* have 5 disk glands; however, some species have only 2 or rarely 3 (e.g., *M. tenuifolia* (Mikan) Woodson, *M. myriophylla* (Taubert) Woodson). Therefore, the variability in the number of disk glands within the genus and the presence of a few species with eglandular and coriaceous leaves (e.g., *M. torosa* (Jacquin) Woodson) show that the only remaining species in *Salpinctes* should be placed in synonymy of *Mandevilla*.

Mandevilla kalmiaefolia (Woodson) J. F. Morales, comb. nov. Basionym: *Salpinctes kalmiaefolius* Woodson, in Gleason, Bull. Torrey Bot. Club 58: 453, pl. 37. 1931. TYPE: British Guiana. Dryish slopes of Savanna Hills, Aug. 1928–Apr. 1929, *Tate 836* (holotype, NY; isotype, MO; photograph, INB ex MO).

Literature Cited

Woodson, R. E. 1931. *In:* Gleason, Botanical results of the Tyler-Duida Expedition. Bull. Torrey Bot. Club 58: 277–506.

———. 1936. Studies in the Apocynaceae IV. The American genera of Echitoideae XII: *Salpinctes*. Ann. Missouri Bot. Gard. 23: 178–181.

———. 1953. Botanical exploration in Venezuela III. Fieldiana, Bot. 28(3): 497–505.

A New Species of *Erica* (Ericaceae) from South Africa

E. G. H. Oliver and I. M. Oliver
Compton Herbarium, National Botanical Institute, P. Bag X7, Claremont 7735, South Africa

ABSTRACT. A new species of *Erica* from the Western Cape Province of South Africa is described and illustrated. Its probable affinities and known distribution and habitat are discussed. *E. hebdomadalis* is a low, spreading species with small, white pendulous flowers and is restricted to the highest altitudes of the eastern Klein Swartberg near Ladismith.

Erica hebdomadalis E. G. H. Oliver & I. M. Oliver, sp. nov. TYPE: South Africa. Western Cape: 3321AD, Ladismith, Klein Swartberg, N slopes of Hoeko Peak, 2040 m, 3 Feb. 1992, *Oliver 10005* (holotype, NBG; isotypes, BM, K, MO, PRE). Figure 1.

Species *Ericae demissae* Klotzsch ex Bentham affinis sed habitu prostrato, floribus pendulis, corolla late cyathiformi glabra, antheris manifestis non exsertis, stigmate manifesto non exserto differt.

Shrublet, low sprawling, fairly dense, up to 0.25 m high, single-stemmed reseeder. *Branches*: numerous main branches, each branch with 4–6 secondary branchlets 5–15 mm long, all terminating in a pendulous inflorescence, all densely pubescent with retrorse simple hairs, occasionally interspersed with retrorse, stouter, plumose, nonsticky gland-tipped hairs. *Leaves* 3-nate, erect, imbricate, 2.0–2.5 × 0.5 mm, oblong to lanceolate, adaxially flattened, abaxially rounded and narrowly sulcate, edges acute and entire, glabrous, edged with reddish, small, nonsticky, very short-stalked glands in young leaves only; petiole 0.4 mm long, appressed, glabrous, edged with small sessile glands. *Inflorescence*: flowers 3-nate in 1 or 2 whorls, umbel-like and terminal on main and secondary branches; pedicel 1–2 mm long, glabrous except for a few scattered, short-stalked, nonsticky gland-tipped hairs and rarely with some simple hairs; bract recaulescent and approximate to the calyx, 1.1–1.6 × 0.4 mm, oblanceolate, as long as sepals, adaxially rounded and narrowly sulcate for ⅓ its length, glabrous, white, occasionally tinged green, glands as in leaf; bracteoles 2, approximate, 1.0 × 0.3 mm, otherwise like the bract. *Calyx* 4-partite, appressed to corolla; segments 1.1 × 0.4 mm, narrowly ovate-attenuate, abaxially rounded and narrowly sulcate about ⅓ their length, glabrous, edged with small, nonsticky, short-stalked glands. *Corolla* 4-lobed, ca. 1.2–1.8 × 2.5 mm, broadly cyathiform, colliculate, glabrous, white; lobes erect, very broadly triangular, subacute, minutely fimbriate to entire. *Stamens* 8, free, manifest; filaments 1 mm long, linear, straight, glabrous; anthers bilobed, dorsifixed near the base, oblong, erect, golden brown, muticous; thecae erect appressed, 0.8 × 0.25 mm, oblong, subfalcate, aculeate-edged and adaxially aculeate; pore ⅓–¼ the length of theca; pollen as tetrads. *Ovary* 4-locular, 0.6 × 0.9 mm, oblate, slightly emarginate, slightly 4-lobed, glabrous, rarely with a few short stiff hairs, white, with dark-red nectaries around the base; ovules 3 per locule, pendulous from an apical placenta; style manifest, erect, straight, 0.9–1.2 mm long, terete, glabrous; stigma simple-truncate. *Fruit* a dehiscent capsule, 1.4 × 2.0 mm, cyathiform, with small apical placenta and remnant style-base, valves fused for $\frac{1}{10}$ their length, spreading, septa only on the columella; *seeds* 0.8 × 0.5 mm, cuneate, trigonous, complanate, with subapical beak at point of attachment, reticulate-areolate, brown, cells irregularly subequal with straight anticlinal walls and numerous pits.

Diagnostic features and discussion. *Erica hebdomadalis* is characterized by its low sprawling habit (maximum height 0.25 m), pendulous flowers with broadly cyathiform glabrous corolla, manifest anthers, and equally long style. It is most closely allied to *E. demissa* Klotzsch ex Bentham, which has an erect habit up to 1.5 m high, erect to spreading flowers, mostly urceolate and glabrous or puberulous, well-exserted anthers and style (the latter much longer than the anthers), and similar indumentum on the branches but at times having numerous plumose gland-tipped hairs admixed. Stokoe (*S.1757* in NBG) specifically noted that the species "flowers downward."

Erica demissa is a variable and complex species. It occurs at low altitudes and is widespread and common on the mountains from the Cedarberg in the northwest through the Klein Karoo to the Van Stadens area near Port Elizabeth in the east, whereas the new species occurs above 2000 m and only on the Klein Swartberg.

Figure 1. *Erica hebdomadalis* E. G. H. Oliver & I. M. Oliver. —A. Branch, natural size. —B. Flowering branchlet. —C. Branch. —D. Branch trichome. —E. Leaf. —F. Flower. —G. Bract. —H. Bracteole. —I. Sepal. —J. Stamen, lateral, ad- and abaxial views. —K. Gynoecium. —K'. Ovary, opened laterally. —L. Capsule. —L'. Capsule, with one valve removed. —M. Seed. All drawn from the type collection, *Oliver 10005* (del. Inge Oliver).

Erica hebdomadalis was first collected by a team of three amateur collectors, H. K. C. Andreae, R. Primos, and T. P. Stokoe, who were the first to visit the highest mountains in the Western Cape in 1928. The type material was collected during a field trip of 13 botanists to study the high-altitude flora of these mountains in 1992 (Linder et al., 1993; McDonald et al., 1993). This is the second species of *Erica* to be described from this trip, the other being the showy and very distinctive *E. roseoloba* E. G. H. Oliver (Oliver & Oliver, 1996).

Distribution and habitat. The species is restricted to the highest parts at the eastern end of the Klein Swartberg mountains toward Seven Week's Poort, where it is quite common on the drier northern slopes and plateau. Andreae and Stokoe re-

corded the species on Seven Week's Poort Mtn. as common and spreading over rocks, with Esterhuysen noting the plants occurring "around bases of rocks." The plants studied on nearby Hoeko Peak (E. G. H. O.) were low and spreading over small rocks and between the very short tussocks of Restionaceae. The general vegetation was very low and alpine-like due to the high altitude (2000–2300 m), where conditions can be extreme, from hot and dry in summer to very cold with snow in winter.

No pollinators were noted visiting the plants during the field trip, despite insects visiting other species of *Erica* flowering in the area. It is postulated that the new species is insect-pollinated. This is based on the possession of nectaries and a simple-truncate stigma (Rebelo et al., 1985).

The species is named after the region where it grows, Seven Week's Poort (Greek, hebdomas = seven, week; Latin, hebdomadalis = of a week; thus covering both aspects of the name). Early records suggest that it took the first travelers seven weeks to negotiate the passage (poort) through this mountain range by oxwagon. Compton's species, *E. ostiaria*, is named after the poort (Latin, ostiarius = belonging to a passage).

Paratypes. SOUTH AFRICA. **Western Cape:** 3321, (-AD), Klein Zwartberg, W of Klein Zwartberg Peak, 6500 ft., 28 Dec. 1928, *Andreae 1281* (BOL); Seven Week's Poort Mtn., upper part of N slopes, 7300 ft., 30 Dec. 1928, *Andreae 1290* (BOL), 2000 m, 25 Dec. 1928, *Stokoe 1757* (NBG), Dec. 1928, *Stokoe 6233* (BOL), neck W of Mtn., towards Steenslangberg, 6000 ft., 14 Apr. 1979, *Esterhuysen 35206* (BOL).

Acknowledgments. Funding for the field survey in the Klein Swartberg using a helicopter was provided by the Systematics Stimulation Programme of the Foundation for Research Development (Council for Scientific and Industrial Research) and by the Department of Nature & Environmental Conservation (Cape Provincial Government).

Literature Cited

Linder, H. P., J. H. Vlok, D. J. McDonald, E. G. H. Oliver, C. Boucher, B.-E. Van Wyk & A. Schutte. 1993. The high altitude flora and vegetation of the Cape Floristic Region, South Africa. Opera Bot. 121: 247–261.

McDonald, D. J., E. G. H. Oliver, H. P. Linder & C. Boucher. 1993. Is there alpine vegetation on the mountains of the south-western Cape? Veld & Flora 79: 17–19.

Oliver, E. G. H. & I. M. Oliver. 1996. Studies in the Ericaceae (Ericoideae) XIX. Two new species of *Erica* from southern Africa. Feddes Rep. 107: 305–310.

Rebelo, A. G., W. R. Siegfried & E. G. H. Oliver. 1985. Pollination syndromes of *Erica* species in the south-western Cape. S. African J. Bot. 51: 270–280.

A New Cauliflorous Species of *Dioclea* Kunth (Leguminosae: Phaseoleae) from Southeastern Brazil

Luciano Paganucci de Queiroz

Universidade Estadual de Feira de Santana, Depto. de Ciências Biológicas. Km 03, BR 116, Campus. 44031-460, Feira de Santana, BA, Brazil. Fax 00-55-75-2248019.
E-mail: lqueiroz@uefs.br

ABSTRACT. A new species of *Dioclea* sect. *Pachylobium* is described under the name of *Dioclea grandistipula* L. P. Queiroz. Although related to *Dioclea rufescens* Bentham, this new taxon is distinguished from other species of *Dioclea* by its cauliflorous pendulous inflorescences and large peltate stipules. It is endemic to the Atlantic forest of the State of São Paulo (southeastern Brazil) and was found during a recent survey for the *Fanerogamic Flora of São Paulo* at the Ecological Station Juréia-Itatins.

Dioclea Kunth is a genus of over 30 species of lianas and shrubs distributed mainly in the Neotropics (Maxwell, 1969). While preparing an account of *Dioclea* for the *Fanerogamic Flora of São Paulo*, five described species were found: *D. glabra* Bentham, *D. rufescens* Bentham, *D. violacea* Martius ex Bentham, *D. virgata* (Richard) Amshoff, and *D. wilsonii* Standley. In addition to these taxa, the following new species was identified.

Dioclea grandistipula L. P. Queiroz, sp. nov. TYPE: Brazil. São Paulo: Iguape, Estação Ecológica Juréia-Itatins, Serra da Juréia, caminho do Imperador, 12 Apr. 1994 (fl), *I. Cordeiro & E. A. Anunciação 1360* (holotype, SP; isotype, HUEFS). Figure 1.

Liana stipulis magnis, peltatis, foliolis oblongis, caudatis, glabriusculis, pedunculis gracilibus, pendulis, cauliforis, petalis albis, antheris dimorphis, discis intrastaminalibus integris marginibus lobatis, fructibus semidehiscentibus, seminibus hilis linearibus. *D. rufescenti* affinis sed stipulis stipellisque longioribus, foliolis glabriusculis et inflorescentiis pendulis, caulifloris differt.

Liana, young branches glabrous to glabrescent, finely striated. *Stipules* persistent, peltate, lanceolate, glabrous, with prominent veins, distal portion acuminate, 1.5–2.1 × 0.6–0.9 cm, proximal portion unequilaterally bifid, 0.6–1.1 × 0.5–0.8 cm. *Leaves* pinnately trifoliolate, petiole and rachis glabrous to glabrescent, petiole 6.9–9.4 cm, rachis 1.4–2.5 cm, stipels longer than petiolule, the proximal linear, 10–13 × 0.6–0.8 mm, the distal subulate, 5–6 mm; petiolules 4–5 mm; leaflets papyraceous, 2–2.5× longer than broad, 7–9 pairs of secondary veins, prominent on both surfaces, minor venation reticulate, upper surface glabrous, lower surface glabrescent but sparsely fuscous-sericeous on main veins, terminal leaflet 9.5–12.5 × 4.5–5.3 cm, obovate to elliptic, caudate and aristate at apex, rounded at base; lateral leaflets 9.6–12.6 × 4.5–5.3 cm, slightly oblique. *Inflorescence* cauliflorous with solitary or 2–3-fasciculate nodose pseudoracemes, 15–36 cm, flowering along ¼–½ of its length, slender, flexuous, pendulous, densely sericeous, canescent; peduncle with lanceolate, peltate, paired sterile bracts, similar to the stipules, to half of its length; nodes capitate, sessile, 1–2 mm across; first-order bracts (at node attachment) ca. 5 × 1.5 mm, caducous, membranous, lanceolate, acuminate, with a basal tuft of canescent hairs, remainder glabrous to sparsely fuscous-sericeous; second-order bracts (at pedicel attachment) ca. 1.8 × 1.5 mm, caducous, suborbicular, fuscous-velutinous; bracteoles ca. 2.5 × 2.1 mm, semi-persistent, suborbicular, fuscous-velutinous; pedicels 2.5–3 mm, fuscous-velutinous. *Calyx* fleshy, 4-lobed, tube 6–7 mm, campanulate, upper margin gibbous, sparsely fuscous-sericeous; upper lobe 3 × 7 mm, deeply emarginate; lateral lobes 3 × 5 mm, ovate; lower lobe 6 × 5 mm, ovate, upcurved, keeled; petals glabrous, claws 5–7 mm; standard 1.3–1.5 × 1.2–1.4 cm, white with wine-colored lines and yellowish target spot, reflexed, flabellate to suborbicular, 2-callose, base 2-plicate-auriculate; wings 1.3–1.5 × 0.7–1 cm, white, obovate, slightly auriculate at base; keel petals 7–9 × 9–10 mm, white, triangular, strongly incurved, vexillary margin with a median lobe, slightly auriculate at base, apex extended in a rounded to truncate beak; androecium pseudomonadelphous, the vexillary stamen free at base by a length of ca. 3 mm; staminal sheath 1.2–1.3 cm, fleshy, glabrous to sparsely pubescent at base, filaments free at apex by a length of 3–4 mm; anthers dimorphic, 5 fertile and

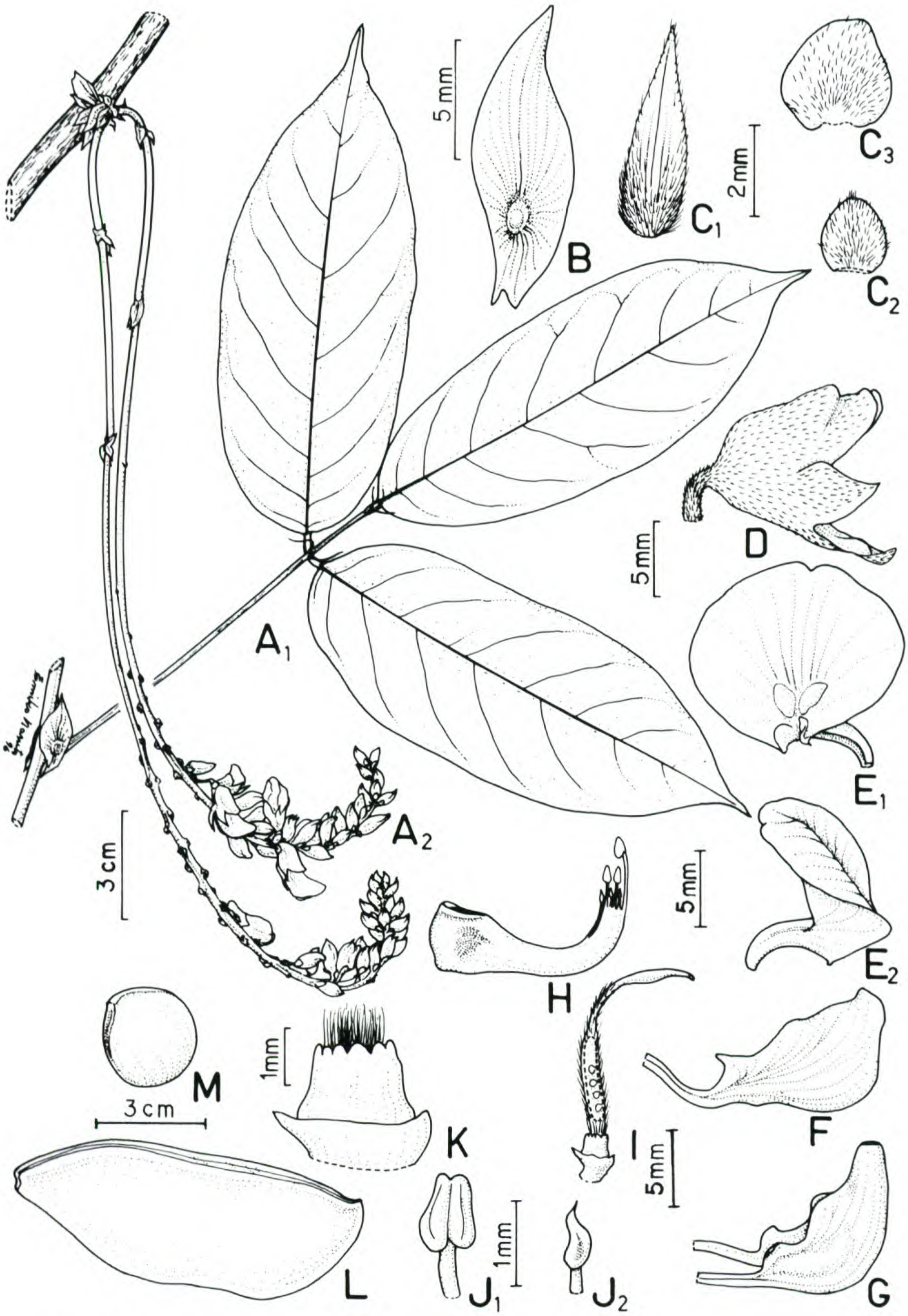


Figure 1. *Dioclea grandistipula*. —A. Habit: A_1. Stem with leaf; A_2. Inflorescence. —B. Stipule. —C. Bracts: C_1. First-order bract; C_2. Second-order bract; C_3. Bracteole. —D. Calyx, side view. —E. Standard: E_1. Front view; E_2. Side view. —F. Wing petal. —G. Keel. —H. Androecium. —I. Gynoecium. —J. Anthers from fertile stamens (J_1) and staminodes (J_2). —K. Intrastaminal disk. —L. Fruit. —M. Seed. A–K, from *Cordeiro & Anunciação 1360* (SP). L, M, from *Mattos & Mattos 15666* (SP).

ovate alternating with 5 sterile and triangular; intrastaminal disk cylindrical with 10-lobed margin; ovary 9–10 mm, subsessile, densely canescent-velutinous, 4-ovulate; style 6–6.5 mm, glabrous, curved, bulbous; stigma truncate. *Fruit* partially dehiscent, opening by the lower suture but not releasing seeds, 8.9–9.5 × 3.7–3.9 × 1.6–2 cm, oblong, margins slightly constricted between seeds, upper suture raised, flanked by two wings, 3 mm wide; valves woody, fuscous-velutinous, glabrescent at maturity, slightly constricted between seeds. *Seeds* 2, ca. 2.7 × 2.4 × 1.4 cm, suborbicular to cuboid, with flat planes of contact, covered with felt-like envelope frequently adhering to the hard seed coat; hilum linear, ca. 2 cm, encircling ca. ⅓ of seed circumference.

Dioclea grandistipula is only known from the coast of the State of São Paulo, southeastern Brazil. The peltate stipules, dimorphic anthers, incompletely fused upper lobes of the calyx, partially dehiscent fruits, and seeds with a long linear hilum enable us to include it in section *Pachylobium* Bentham (1859). To my knowledge, it is the only *Dioclea* species from eastern Brazil to present cauliflory; within the genus, cauliflory is recorded only for *D. malacocarpa* Ducke (sect. *Pachylobium*, Ducke, 1922; Maxwell, 1969), and *D. macrocarpa* Huber (sect. *Macrocarpon*; Amshoff, 1939; Maxwell, 1969, 1988), distributed in Amazonia northward to the Guyana plateau and westward to Central America.

Dioclea grandistipula has its closest affinities with *D. rufescens* Bentham, also from southeastern Brazil (States of São Paulo, Minas Gerais, and Rio de Janeiro) but occurring in different vegetation types. While *D. grandistipula* is found in the Atlantic forest near the coast, *D. rufescens* occurs in the semi-deciduous forests of inland plateaus in the states cited.

Dioclea grandistipula may be distinguished from the other southeastern Brazilian species of *Dioclea* by its almost glabrous leaflets, consistently larger stipules and basal stipels (at least 2.1 cm and 1 cm long, respectively), slender, pendulous cauliflorous inflorescences, and white petals. It has been collected in flower in April and May, and in fruit in December.

Paratypes. BRAZIL. **São Paulo:** Iguape, Estação Ecológica Juréia-Itatins, caminho do Imperador, 24 Apr. 1991 (fl), *M. C. H. Mamede, M. R. F. Melo, E. A. Anunciação & M. A. Carvalhaes 423* (SP), 15 May 1991 (fl), *L. Rossi & E. L. M. Catharino 893* (SP); São Sebastião, "Ilha de São Sebastião," 27 Dec. 1972 (fr), *J. Mattos & N. Mattos 15666* (SP).

Acknowledgments. I am indebted to Inês Cordeiro for the provision of material for study and hospitality at SP, to Elisete A. da Anunciação and Lúcia Rossi for valuable information about the habitat, to Alasdair G. Burman for improvement of the English text and revision of the Latin description, to Richard H. Maxwell and Dan Harder for critical review of the manuscript, and to Emiko Naruto for the accompanying drawings. This paper is a result of research on the Diocleinae for the *Fanerogamic Flora of the State of São Paulo* (Fundação de Amparo a Pesquisa do Estado de São Paulo), and Botanical Diversity of the Juréia Mountains (supported by The John D. & Catherine T. MacArthur Foundation).

Literature Cited

Amshoff, G. J. H. 1939. On South American Papilionaceae. Meded. Bot. Mus. Herb. Rijks. Univ. Utrecht 52: 66–71.

Bentham, G. 1859. Leguminosae. *In:* Martius, Flora Brasiliensis, vol. 15, part 1: 160–167.

Ducke, A. 1922. Plantes nouvelles ou peu connues de la région amazonienne. Arch. Jard. Bot. Rio de Janeiro 3: 169–173.

Maxwell, R. H. 1969. The Genus *Dioclea* (Fabaceae) in the New World. Ph.D. Dissertation, Southern Illinois University, Carbondale, Illinois.

———. 1988. A new species of *Dioclea* Kunth (Diocleinae, Fabaceae) from the Venezuelan Guayana. Ann. Missouri Bot. Gard. 75: 730–732.

New Species of *Sapranthus* B. C. Seemann and *Unonopsis* R. E. Fries (Annonaceae) from Mesoamerica

George E. Schatz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Two new species of Annonaceae, *Sapranthus viridiflorus* G. E. Schatz and *Unonopsis stevensii* G. E. Schatz, are described from Mesoamerica. Color photographs of the new species can be accessed over the World Wide Web by searching the name in W³TROPICOS at *http://www.mobot.org/Pick/Search/pick.html.*

RESUMEN. Se decriben dos especies nuevas de Annonaceae, *Sapranthus viridiflorus* G. E. Schatz y *Unonopsis stevensii* G. E. Schatz, de Mesoamérica. Fotografías a color de las especies nuevas son accesibles buscando el nombre en las páginas de Internet de W³TROPICOS en la siguiente dirección: *http://www.mobot.org/Pick/Search/pick.html.*

In anticipation of the upcoming publication of the *Flora de Nicaragua*, I provide here names and descriptions for two undescribed species of Annonaceae from Mesoamerica. *Sapranthus viridiflorus* G. E. Schatz is the southernmost of seven species in a genus extending from the states of Sinaloa and Veracruz, Mexico, to the province of Los Santos, Panama. In contrast to the other species of *Sapranthus* B. C. Seemann, which occur in seasonally dry deciduous forest and possess membranaceous reddish to deep purple petals with evident venation, *S. viridiflorus* occurs in moist to wet evergreen forest and exhibits thick, fleshy green petals lacking venation at maturity.

Unonopsis R. E. Fries is a genus of ca. 40 species distributed from Belize to Bolivia in wet, evergreen forest, with 6 species currently known from Mesoamerica, and an additional 4–5 new species awaiting description. Although not yet known from Nicaragua, *Unonopsis stevensii* G. E. Schatz is to be expected in the southeastern region of the country along the Río San Juan just to the north of Cerro Coronel and Barra del Colorado in Costa Rica, the sole locality for the new species.

Sapranthus viridiflorus G. E. Schatz, sp. nov. TYPE: Costa Rica. Heredia: La Selva Biological Station of the Organization for Tropical Studies, 4 km S of Puerto Viejo de Sarapiquí, 10°26′N, 84°01′W, 35 m, 15 Feb. 1984 (fl), *G. E. Schatz 963* (holotype, MO; isotypes, CR, WIS). Figures 1, 2, and *http://hoya.mobot.org/mobot/research/image/01602308_001.jpg, http://hoya.mobot.org/mobot/research/image/01602308_002.jpg*

A speciebus aliis *Sapranthi* petalis enervibus carnosis viridibus et carpellis 2–5 differt.

Tree to 12 m tall, the young branches brownish gray tomentose. Leaves membranaceous, the petiole 0.4–1.0 cm long, shallowly canaliculate, brownish gray tomentose; lamina elliptic to oblong-obovate, 5.6–29.8 cm long, 2.7–12.1 cm broad, the base cuneate to rounded and somewhat truncate, the apex acuminate to cuspidate, the upper lamina surface sparsely white velutinous, the lower surface white velutinous, the margins finely ciliate; venation weakly brochidodromous with 8–15 lateral veins per side, the midrib slightly impressed and densely white velutinous above, especially toward the base, prominently elevated and short white hirsute below, drying purplish black, the slender lateral veins elevated and short white hirsute below. Flowers solitary, pendent, terminal but appearing leaf-opposed (or rarely cauliflorous and borne on older wood), with a fruity fragrance, albeit with a slightly fetid component; pedicel 1.0–1.7 cm long, sparsely tomentellous, bearing a lanceolate-ovate to rounded bract near the base to 0.8 cm from the base, 0.5–0.9 cm long, 0.3–0.5 cm broad, the apex acute to obtuse, the base decurrent along the pedicel, the margins revolute. Sepals triangular, 0.7–0.8 cm long, 0.5–0.7 cm broad, the apex acute, slightly reflexed, the base truncate, tomentellous outside. Petals 6, in 2 subequal imbricate whorls, membranaceous and with venation evident in bud, becoming fleshy and lacking any evident venation at anthesis when fresh, revealing faint venation when

Figure 1. Flower of *Sapranthus viridiflorus* G. E. Schatz with one inner petal removed (*G. E. Schatz 963*; photo: G. E. Schatz).

Figure 2. Fruiting branch of *Sapranthus viridiflorus* G. E. Schatz (*G. E. Schatz 1031*; photo: G. E. Schatz).

dried, green with a purple blush at the base inside when fresh; outer petals lanceolate to ovate, 2.6–2.9 cm long, 1.2–1.5 cm broad, the apex acute, the base rounded, flat, thin, sparsely tomentellous initially outside, at length glabrescent; inner petals ovate, 2.4–2.8 cm long, 1.1–1.3 cm broad, the apex acute, the base cuneate, concave, the margins strongly revolute, glabrous both inside and outside, bearing a shallowly triangular white patch (vestigial food body) at the base inside, 2.5 mm long, 4.5 mm broad. Stamens ca. 60, 1.8–2.3 mm long, the filament 0.3 mm long, the thecae 1.4–1.9 mm long, the apical prolongation of the anther connective truncate discoid, 0.1 mm thick, minutely tuberculate, purple; pollen disulculate, with an equatorial ridge outlining the sulculi, the tectum very shallowly verrucate. Carpels 2–5, usually 4; stigma napiform, 1.5 mm long, 2 mm broad, with a medial furrow, setaceous, yellowish white; ovaries prismatic, 2 mm long, setose; ovules 10–17, in two rows. Monocarps oblong, short-stipitate, to 10 cm long, 4.5 cm diam., the apex and base rounded, green at maturity, densely puberulous; stipe 0.3 cm long, attached obliquely to the monocarp; seeds lunate, 2.3 cm long, 1.5 cm broad, 0.7 cm thick, the seed coat smooth, light orange-brown.

Distribution. *Sapranthus viridiflorus* is known from moist to wet forest in southeastern Nicaragua and Costa Rica, and from a single collection from Los Santos, Panama. In Costa Rica, it ranges in elevation from sea level to 700 m in the Turrialba region, 1700 m in San José province in the Cerros de Escazú and 1110 m at Estación Cacao in the Tilarán range, as well as near sea level on the Pacific slope in the Carara Reserve in Puntarenas province. The collection from Los Santos province in Panama represents the only collection of the genus *Sapranthus* from Panama. At La Selva Biological Station, *S. viridiflorus* occurs on only the most recent alluvial soils.

Sapranthus viridiflorus differs from all other *Sapranthus* species by its fleshy, green petals that lack visible venation, and the low number of carpels (2–5, in contrast to 9–38 throughout the rest of the genus). It possibly represents the penetration of a widespread, Pacific dry forest genus into wetter forests, perhaps during drier glacial periods. In comparison to the dry forest species, *S. viridiflorus* exhibits probable paedomorphic adaptive responses to the lower light levels and high rainfall in wet forests. Character shifts that accompany the wet forest habitat include: (1) reduced overall flower size; (2) retention of green petals with only a slight purple blush at their base; (3) fleshy vs. membranaceous petals with a subsequent loss of visible venation; (4) loss of the fleshy food body at the base of the 3 inner petals; and (5) reduction in the number of carpels. Indeed, the fleshy, stiff texture of mature petals of *S. viridiflorus* might lead one at first to reject its inclusion in the genus. Petals at the bud stage, however, clearly show the characteristic *Sapranthus* petal venation, and the large, green, probable mammal-dispersed fruiting monocarps are typical of section *Sapranthus.* Along with morphological and developmental changes, shifts in both floral odor (from fetid to sweet and fruity, albeit with a very slight component of the fetid odor remaining) and pollinators (from Tenebrionidae, which consume the fleshy food bodies of *S. palanga* R. E. Fries at Santa Rosa National Park in Guanacaste, Costa Rica, to Nitidulidae at the La Selva Biological Station [pers. obs.]) have accompanied the successful penetration into wetter forest.

Paratypes. COSTA RICA. **Alajuela:** Reserva Biológica Monteverde, Río Caño Negro y Aguas Gatas, 10°23′N, 84°47′W, 600 m, 18 Oct. 1989 (fr), *E. Bello 1385* (MO); Parque Nacional Rincón de La Vieja: Upala, 10°46′N, 85°17′W, 900 m, 29 Feb. 1988 (fl), *G. Herrera 1564* (BRIT, CR, F, MEXU, MO, NY, PMA, U, US, WIS). **Cartago:** El Zapote nature reserve, 5 km S of Turrialba, 700 m, 1 Mar. 1987 (fl, fr), *W. Burger & J. Gomez-Laurito 12040* (CR, F, MO); Florencia Sur IICA, Turrialba, 625 m, 11 May 1972 (st), *L. Poveda 84* (CR); Forêts de Turrialba, 570 m, Nov. 1893 (fr), *Tonduz 8355* (US); Forêts de las vueltas Tucurrique, 635–700 m, Jan. 1899 (fr frag.), *Tonduz 13138* (US); forest near Turrialba (IICA Experimental Plot), ca. 2500 ft., 8 July 1965 (fl), *J. W. Walker 132* (CR, F, GH, MO, U, WIS), 4 Apr. 1966 (fr), *J. W. Walker 364* (CR, DUKE, F, GH, MO, U, US, WIS); Atirro Turrialba, pocos orillas del Río Atirro, 400–500, 9 Dec. 1985 (fr), *N. Zamora 1154* (CR). **Guanacaste:** Cantón de Liberia, Parque Nacional Guanacaste, Estación Cacao, 10°55′45″N, 85°28′15″W, 1100 m, 23 Nov. 1990 (fr), *R. Espinoza 41* (INB, MO), 10°55′38″N, 85°29′11″W, 1060–1100 m, 1 June 1990 (fr), *F. Quesada 38* (CR, INB, MO, U); Parque Nacional Rincón de La Vieja, Hacienda Santa Maria, 10°48′N, 85°19′W, 800–900 m, 2 Oct. 1987 (fr), *G. Herrera & R. Robles 754* (CR, F, MEXU, MO, NY, U, US, WIS), 10°46′05″N, 85°17′40″W, 1000 m, 17 Sep. 1990 (fr), *G. Rivera 543* (INB, MO). **Heredia:** Finca La Selva (type locality), 90 m, 17 Sep. 1969 (st), *G. Frankie 400a* (MO), *400c* (F); hills to the S of the Río Sarapiquí at Chilamate de Sarapiquí, 10°27′N, 84°04′W, 60–100 m, 4 July 1985 (fr), *M. Grayum et al. 5555* (MO); La Selva Biological Station, 1 Dec. 1980 (fr), *B. Hammel 10620* (DUKE), 7 Apr. 1982 (fr), *B. Hammel 11601* (DUKE), 20 Jan. 1973 (fl), *G. Hartshorn 1096* (CR, F, MO, U), 1 Aug. 1984 (fr), *G. E. Schatz 1031* (CR, MO, WIS), 24 Sep. 1981 (fr), *D. Smith 283* (DUKE), 26 July 1979 (fr), *J. Sperry 1972* (DUKE). **Limón:** Sixaola region, headwaters of Quebrada Mata de Limón, central fork and hills between central and westernmost forks, Finca Anai, 9°35′N, 82°39′W, 25–40 m, 19 Nov. 1984 (fr), *M. Grayum 4503* (CR, MO); Cordillera de Talamanca, Canton de Matina, el camino entre Río Barbilla y lagunas, cabeceras de Río Caño Seco (Quebrada Barreal), 10°01–02′N, 83°27′W, 300–450 m,

Figure 3. Fruiting branch of *Unonopsis stevensii* G. E. Schatz (*W. D. Stevens 24716*; photo: O. M. Montiel).

16 Oct. 1988 (fr), *G. Herrera 2203* (CR, F, MO, U); 10–15 km SW of Siquirres along Río Pacuare, 10°06′N, 83°28′W, 100 m, 16 Feb. 1991 (fl, fr), *P. J. M. Maas et al. 7956* (CR, MO(3), U), *7961* (CR, MO(2), U); Paturages a la Colombiana, Llanuras de Santa Clara, 200 m, June 1899 (fl, fr), *Pittier 13404 (Donnell Smith 7576)* (G, US(3)); Cerro Coronel, E of Laguna Danto, 10°41′N, 83°38′W, 60–100 m, 15 Mar. 1987 (st), *W. D. Stevens et al. 24881* (MO). **Puntarenas:** between guard station and Quebrada Bonita, Carara Reserve, 9°47′N, 84°36′W, ca. 40 m, 25 July 1985 (fr), *M. Grayum & R. Warner 5695* (CR, MO). **San José:** near Villa Colon, slopes of Cedral, close to Pacaca River, ca. 1000 m, 5 Apr. 1966 (fr), *L. Fournier & Salas 907* (WIS); Cantón de Mora, valle del Tárcoles, Alto Tigre, al E de Piedras Negras, 9°54′50″N, 84°17′40″W, 800 m, 14 Feb. 1994 (fr), *E. Lépiz & Q. Jiménez 170* (CR, INB, MO, U); Ciudad Colón, Z.P. El Rodeo, Bajo Morales, 9°55′01″N, 84°15′01″W, 800 m, 22 Sep. 1993 (st), *J. F. Morales et al. 1733* (CR, INB, MO, U); Cantón de Acosta, Z.P. Cerros de Escazú, Cuenca del Río Tabacia, 9°50′52″N, 84°04′40″W, 1600–1700 m, 14 May 1994 (st), *J. F. Morales 2770* (CR, INB, MO). NICARAGUA. **Río San Juan:** near Caño Chotaleno, 20 km NE of El Castillo, 200 m, 18–21 Apr. 1978 (fr), *D. Neill & P. Vincelli 3612* (MO); orillas del Rio Santa Cruz, afluente del Rio San Juan, 11°02′N, 84°24′W, ca. 42 m, 22 Mar. 1985 (st), *P. Moreno 25555* (MO). PANAMA. **Los Santos:** Valle Punta Blanca, W of Tonosí, 21 Apr. 1968 (fr), *L. Holdridge 6231* (MO).

Unonopsis stevensii G. E. Schatz, sp. nov. TYPE: Costa Rica. Limón: Cerro Coronel, E of Río Zapote, from E of new road to Raphia swamp, within 1 km of Río Colorado, 10°40′N, 83°40′W, 10–40 m, 12 Mar. 1987 (fl, fr), *W. D. Stevens et al. 24716* (holotype, MO; isotypes, CR, F, INB, HNMN, K, MEXU, MO, OWU, PMA, U, UNAN, US, WIS). Figure 3 and *http://hoya.mobot.org/mobot/research/image/50114934_001.jpg*

A *Unonopsi panamensi* R. E. Fries petiolis foliorum brevioribus, base laminae rotundata ad vulgo subcordata, floribus luteis minoribus, carpellis 3–7 differt.

Slender treelet to tree, 3–12 m tall, the young branches glaucous. Leaves chartaceous, the petiole 0.2–0.3(–0.4) cm long, stout, initially glaucous; lamina narrowly lanceolate to oblong to oblong-elliptic to oblanceolate, sometimes slightly falcate, 12.0–25.0 cm long, 2.0–6.3 cm broad, the base rounded to usually subcordate and slightly asymmetrical, the apex long-acuminate to caudate, the acumen to 2 cm long, the upper and lower surfaces glabrous, the venation weakly brochidodromous

with 13–16 lateral veins per side, the midrib elevated above and below. Flowers in 1–2-flowered condensed rhipidia less than 0.4 cm long, axillary in the foliate zone, ramiflorous just below the foliate zone, or occasionally cauliflorous on the main trunk, the pedicel 0.7–1.2 cm long, ferruginous puberulent, bearing a minute basal bract; sepals triangular, 0.2 cm long, 0.2 cm broad, ferruginous puberulent; petals 6, in two subequal valvate whorls, pale to bright yellow, broadly ovate, 0.4–0.5 cm long, 0.3–0.4 cm broad, concave, the apex acute to obtuse, the outer petals ferruginous puberulent-sericeous outside, the inner petals glabrous outside except puberulent-sericeous along the triangular keel corresponding to the area not covered by the overlapping outer petals; stamens ca. 30, 1.0–1.1 mm long, the apical prolongation of the anther connective truncate discoid; carpels 3–7, the ovary 1.3–1.4 mm long, ferruginous sericeous; ovules (1–)2. Fruit a cluster of stipitate, usually 1-seeded monocarps, the pedicel elongating to 1.8 cm long, the monocarps globose to short cylindrical, 1.2–1.8 cm diam., orange-red, glaucous, the stipe slender, 0.9–1.4 cm long, to 0.1 cm diam.; seeds flattened globose, 1.0 cm diam., 0.5 cm thick, light reddish brown, foveolate, with an equatorial ridge.

Distribution. *Unonopsis stevensii* is thus far known only from wet evergreen forest in northeastern Costa Rica in the region of Barra del Colorado and Cerro Coronel near the mouth of the Río Colorado.

Unonopsis stevensii appears to be most closely related to *U. panamensis* R. E. Fries, which is known from the former Canal Zone in Panama to the Pacific side of Costa Rica from the Osa Peninsula to east of Quepos. The two species share narrowly lanceolate to oblong-elliptic to oblanceolate leaves that are often somewhat falcate, and small flowers with usually more than one ovule, often borne on older wood (cauliflory). However, the petiole in *U. stevensii* is distinctly shorter (0.2–0.3 vs. 0.4–0.7 cm), the leaves often approaching subsessile, and the leaf base is distinctly rounded to subcordate vs. acute in *U. panamensis*. In addition, flowers of *U. stevensii* are smaller than those of *U. panamensis* (0.4–0.5 vs. 0.7 cm long), are yellow vs. cream, and have fewer carpels (3–7 vs. 10–20). The species epithet honors W. D. Stevens, who first collected the species, and who has spearheaded the *Flora de Nicaragua* project.

Paratypes. COSTA RICA. **Limón**: Cerro Coronel, E of Laguna Danto, 10°41′N, 83°38′W, 20–170 m, 16–23 Jan. 1986 (fr), *W. D. Stevens 23647* (CR, MO), 15–20 Sep. 1986 (fl, fr), *W. D. Stevens 24514* (CR, MO, U), 14 Mar. 1987 (fl, fr), *W. D. Stevens et al. 24832* (MO), E of Río Zapote along and above new road within 1 km of Río Colorado, 10°41′N, 83°38′W, 10–40 m, 13–14 Sep. 1986 (fl), *W. D. Stevens 24245* (CR, MO), 13–14 Sep. 1986 (fr), *W. D. Stevens 24282* (CR, MO, U); Refugio Nacional Barra del Colorado, fields and pastures between Río Cirripocito and Río Sardina, 10°38′N, 83°45′W, 12 m, 22 Apr. 1990 (fl, fr), *M. Grayum 9822* (CR, MO, U).

A New *Zamia* (Zamiaceae, Cycadales) from Eastern Chiapas, Mexico

Bart Schutzman
Department of Environmental Horticulture, University of Florida, 1525 Fifield Hall, Gainesville, Florida 32611-0670, U.S.A.

Andrew P. Vovides
Instituto de Ecología, A.C., Apartado Postal 63, 91000 Xalapa, Veracruz, Mexico

ABSTRACT. *Zamia lacandona*, a member of the *Z. splendens* species group, is described from the Selva Lacandona of eastern Chiapas, Mexico. It is distinguished from *Zamia splendens* Schutzman by its usually single arcuate leaf with falcate leaflets, erect short-peduncled megasporangiate strobili, decumbent microstrobili, and chromosome number of $2n = 16$, 17, or 18.

When *Zamia splendens* was described (Schutzman, 1984), collections from the Selva Lacandona of eastern Chiapas were recognized as somewhat more robust and possibly distinct, but were still ascribed to *Z. splendens* in the publication. During two subsequent botanical expeditions to southern Mexico, one in 1984 by the first author and a second one in 1993 by the second author and Terrence Walters and Charles Hubbuch of Fairchild Tropical Garden, specimens were collected in the vicinity of the Mayan ruins in the Selva Lacandona. Schutzman's (1984) earlier decision to include the eastern populations was conservative, because it was not known at that time whether a continuum in morphological features would bridge the morphological "gap" or discontinuity between the western and eastern Chiapan populations. Three significant facts clarified the question. First, specimens collected by the first author in the Lacandona forest produced cones for the first time in 1993, demonstrating differences in cone morphology and habit from *Z. splendens*. Second, plants of *Z. splendens* almost identical to the type specimen were discovered in nearby Tabasco during the above-mentioned 1993 expedition, extending the distribution range of *Z. splendens;* this greatly reduced the possibility that a morphological continuum of one large variable species existed. Third, the Lacandona plants have distinct cytological features distinguishing them from *Z. splendens*. Thus, it was decided that the Lacandona plants are, indeed, worthy of specific status. The large, normally solitary, robust-petioled leaf and relatively small caudex distinguish this species from its congeners in the wild, but in cultivation these features can change and should only be used to distinguish species in conjunction with other characteristics, such as the finely toothed leaflets and cone habit characters (discussed below).

Zamia lacandona Schutzman & Vovides, sp. nov. TYPE: Mexico. Chiapas: Selva Lacandona, July 1984 (male pl), *Schutzman 517* (holotype, FLAS; isotype, XAL). Figure 1a–h.

Haec species *Z. splendenti* Schutzman affinis sed apice strobilorum femineorum apiculato, erecto, foliolis novis xerampelinis et non roseis, et dentibus foliolorum tenuibus et non grossis differt.

Plants dioecious, 15–60 cm tall. Caudex subterranean, 17–40 cm long, 4.5–8 cm diam. Leaves usually 1, occasionally 2, depending upon condition of the plant and its environment, arcuate, sparingly pubescent upon emergence, 30–100 cm long, 34–80 cm wide; leaflets 7–12 pairs per leaf, opposite to subopposite on a single leaf, linear-lanceolate to slightly oblanceolate, proximal leaflets subfalcate, 13–42 cm long, 1.5–5 cm wide; apex acuminate, equal to unequal; margin subrevolute; marginal teeth in upper half of leaf, 1.0–1.25 mm; base attenuate, reddish brown when expanding, dark green when mature; articulation with rachis dark brown, 5–10 mm wide; petiole semi-terete, dark greenish brown covered with brown tomentum, spinose through approximately ¾ of its length from the base, 20–70 cm long, 10–20 mm diam.; spines terete, 0.8–4 mm long, 0.5–1 mm diam.; petiole base massive and almost encompassing entire apex of caudex, 1.5–3 cm wide; cataphylls chartaceous, elongate triangular, cone cataphylls narrow-triangular, pubescent, 2.8–6.3 cm long, 0.4–1.2 cm wide, leaf cataphylls deltoid with aristate apex, 2.2–3.4 cm long, base 2.3–3.8 cm wide. Microspo-

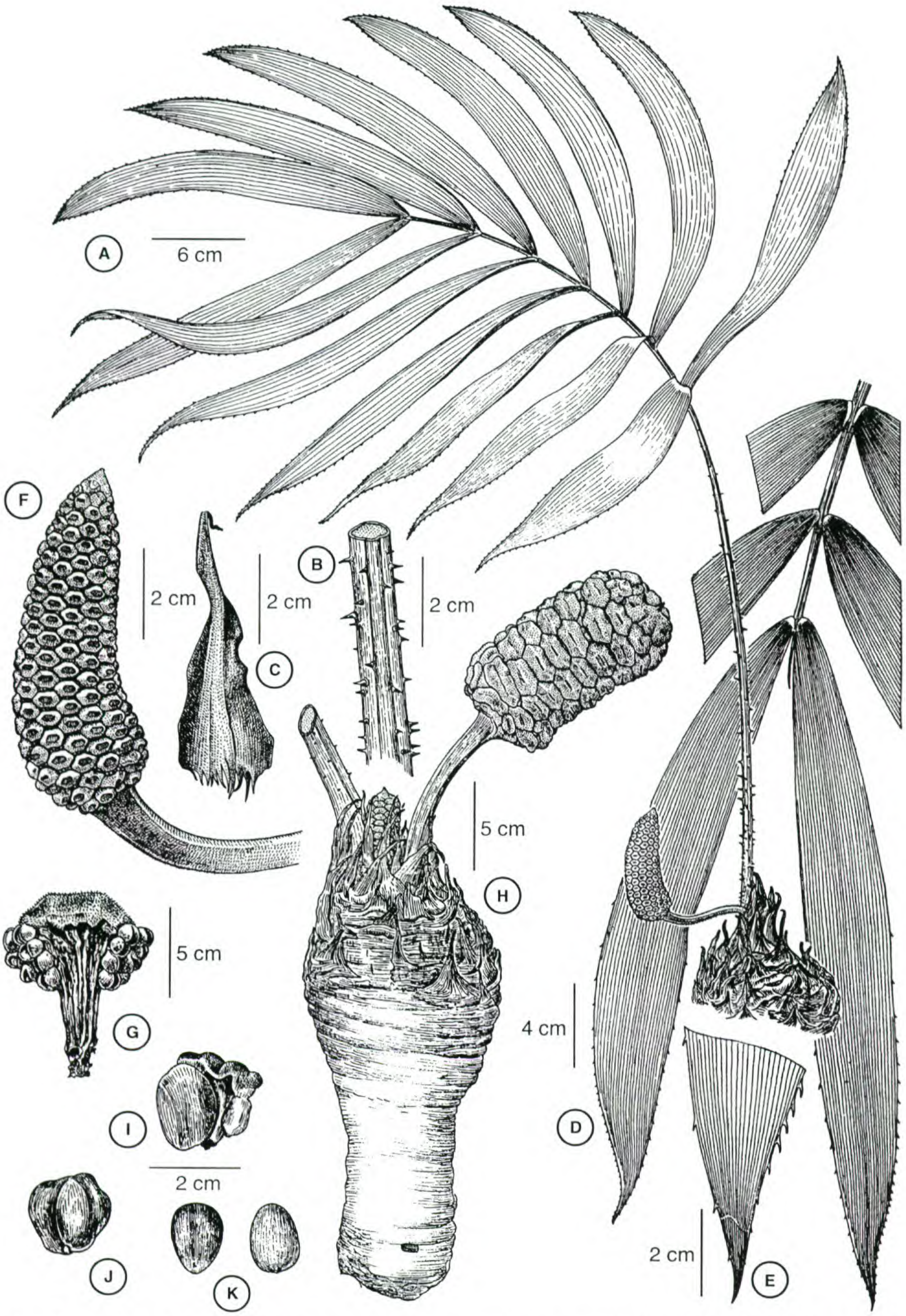


Figure 1. *Zamia lacandona* Schutzman & Vovides, sp. nov. —A. Habit. —B. Petiole detail. —C. Leaf cataphyll. —D. Leaf detail. —E. Leaf apex. —F. Microstrobilus. —G. Microsporophyll. —H. Caudex with megastrobilus. —I. Megasporophyll with attached seed. —J. Seed. —K. Seeds with sarcotesta removed.

rangiate strobili decumbent, cylindrical to conic, dark beige to light brown, apiculate, tomentulose, 6.5–7.4 cm long, 1.8–2.5 cm diam.; peduncle puberulent, 10–12 cm long, 0.5–0.8 cm diam.; microsporophylls cuneiform, puberulent, the distal ends truncate-hexagonal with a short hexagonal-truncate protuberance; microsporangia spheroidal, 14–18 (usually 16) per sporophyll, eight proximal to each margin of fertile area of sporophyll, aggregated into sori of two microsporangia each, dehiscing by longitudinal sutures. Megasporangiate strobilus cylindrical, barrel-shaped with an apiculate apex, chocolate brown with lighter beige hexagonal protruding facets, tomentulose, 12–14 cm long, 6–7 cm diam.; peduncle puberulent, 10–11 cm long, 0.8–1.0 cm diam., megasporophylls cuneiform-peltate, the distal ends hexagonal-truncate with a short hexagonal-truncate protuberance with horizontal groove, 1.7–2.0 cm long, 1.7–2.2 cm wide, short axis 1.1–1.6 cm tall; ovules two per megasporophyll. Seed irregularly angular, turning bright red at maturity, 1.6–1.8 cm long, 1.4–1.6 cm diam.; sclerotesta smooth, light brown. Chromosome number $2n = 16, 17, 18$.

Etymology. The species is named for the Lacandona rainforest ("Selva Lacandona") of eastern Chiapas, which itself is named for the Lacandona Indians of Mayan descent who inhabit the forest.

Distribution and ecology. The species is found in the Selva Lacandona in eastern Chiapas and adjacent areas, where it is found in primary forest, secondary successional regrowth such as abandoned cornfields, and continually disturbed areas such as roadsides, which are burned yearly to clear dead brush and tall grass. Regrowth of the plant is quite noticeable, as its large reddish brown new leaf makes it clearly distinguishable from other vegetation. The vegetation type of the undisturbed areas in which it is found is the "bosque tropical perennifolio" of Rzedowski (1978), or "selva alta perennifolia" of Miranda (1963). This species' subterranean caudex protects it from destruction by the slash-and-burn agricultural practices of subsistence farmers; arborescent species such as *Z. inermis* Vovides, Rees & Vázquez-Torres and *Z. soconuscensis* Schutzman, Vovides & Dehgan disappear entirely from cultivated areas because they cannot regenerate, making them all the more vulnerable to extinction. Subterranean species such as *Z. lacandona* are more apt to be decimated by commercial collection than by slash-and-burn agriculture, a fact that leads us to obscure the precise locality in this description.

Taxonomic relationships. The description of *Zamia lacandona* increases to five the number of closely related species in this group, which also includes *Z. splendens*, *Z. cremnophila* Vovides, Schutzman & Dehgan, *Z. purpurea* Vovides, Rees & Vázquez-Torres, and *Z. standleyi* Schutzman.

Emergent leaf color. Whereas *Zamia splendens* emerges bright pink or green, depending on the population examined (one or both colors may be found in a single population), *Z. purpurea* leaves are strictly deep reddish purple upon emergence. The leaves of *Z. standleyi* are brown, bronze, or light green when emerging. Those of *Z. lacandona* are reddish to purplish brown.

Leaf habit. Both *Zamia standleyi* and *Z. lacandona* possess arcuate leaves, while those of *Z. cremnophila* are pendent. *Zamia splendens* and *Z. purpurea* have relatively more erect leaves, with leaflets slightly arching.

Habit of strobili (Fig. 2). *Zamia lacandona* and *Z. standleyi* both have sexual dimorphism in the habit of micro- and megasporangiate strobili. The microsporangiate strobili are decumbent, while the megasporangiate strobili are erect. *Zamia splendens* and *Z. purpurea*, however, have decumbent micro- and megasporangiate strobili, and the mega- and microsporangiate strobili of *Z. cremnophila* are erect.

Color of strobili. The microsporangiate strobili of *Zamia lacandona* are beige to light brown, while those of *Z. standleyi* are darker brown, and the remaining three species have even darker, coffee-colored microsporangiate strobili. The megasporangiate strobili of *Z. lacandona* are two-toned, with darker protuberant hexagonal megasporophyll apices.

Caudex. The caudex of *Zamia lacandona* is distinctive because it is the smallest relative to leaf size of any other Mesoamerican species thus far examined. All the other species in this group, and the other more distantly related Mesoamerican species, appear to possess larger caudices while supporting the same amount of vegetative growth. This could be related to the rainforest habitat of *Z. lacandona.*

Leaflet shape and denticulation. The leaflet shapes and toothing of the five species are almost sufficient by themselves to distinguish the five members of this group of species (see Fig. 3). The major differences between the species are length/width ratio, marginal denticulation, and how falcate each species is. *Zamia cremnophila, Z. standleyi,* and *Z. lacandona* have falcate leaflets, while those of *Z. purpurea* and *Z. splendens* do not.

Other leaflet characteristics. *Zamia standleyi* is the only member of the group to possess longitudinal "folding" of the leaflets, and *Z. purpurea* is

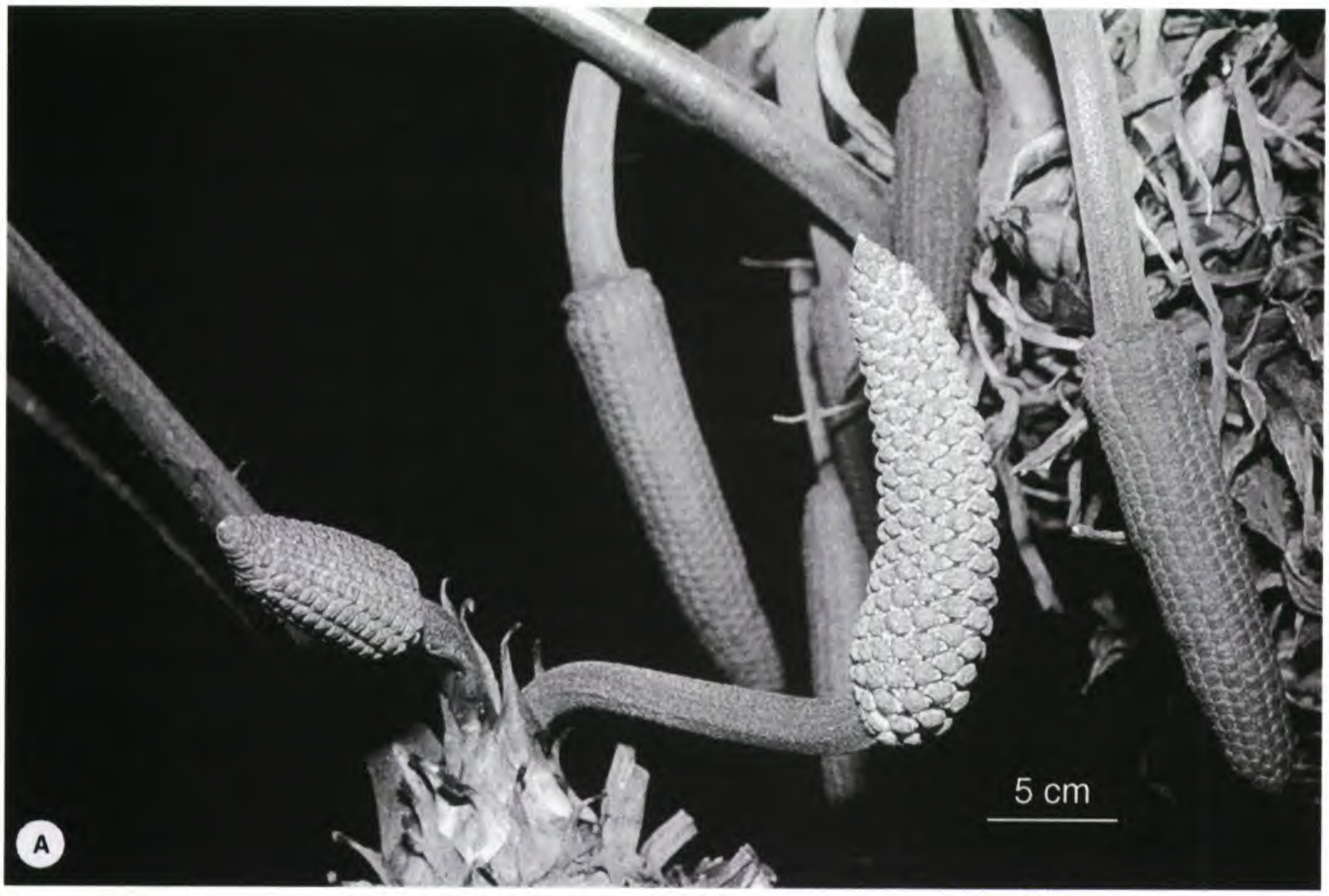


Figure 2. Comparison of strobilar habit and morphology between *Zamia lacandona* and *Z. splendens*. —A. Decumbent microstrobili of *Z. lacandona* vs. pendent microstrobili of *Z. splendens*. —B. Erect, short-peduncled megastrobilus of *Z. lacandona* vs. decumbent or pendent, long-peduncled megastrobili of *Z. splendens*. Photos courtesy of Loran Whitelock.

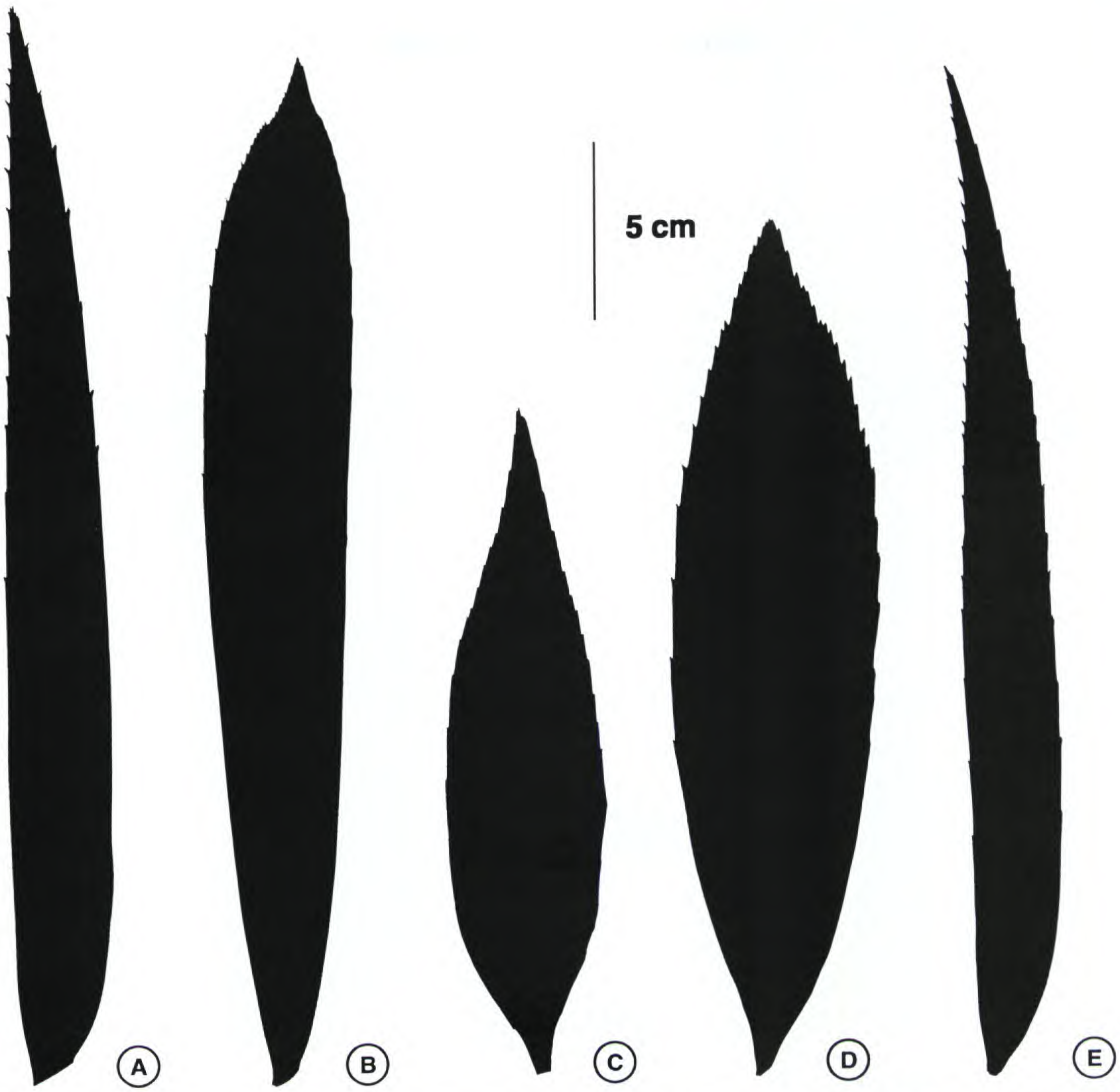


Figure 3. Comparison of leaflet shapes and sizes in the *Zamia splendens* species group. —A. *Z. cremnophila*. —B. *Z. lacandona*. —C. *Z. purpurea*. —D. *Z. splendens*. —E. *Z. standleyi*.

readily identifiable by its pronounced and often raised leaflet venation.

Chromosome number. With the exception of *Zamia lacandona* ($2n = 16$, 17, or 18), all known members of this species group have a diploid chromosome number of $2n = 16$.

Chromosomal studies. Root tip mitosis was studied according to the technique of Schutzman et al. (1988). Six individuals from three localities were examined, and herbarium vouchers were deposited at XAL. Counts of $2n = 16$, 17, and 18 were obtained. Camera lucida drawings were made from the best metaphase cells, where measurements were taken of the chromosomes and arranged in putative pairs to construct the idiograms. Classification of the chromosomes was according to Levan et al. (1964), modified by Schlarbaum and Tsuchiya (1984). Photomicrographs were taken on Kodak Plus-X 125 ASA film by a Zeiss Photomicroscope (Fomi III) fitted with a ×63 planapochromatic objective and phase contrast optics.

The new species differs in cytology with respect to *Zamia splendens* and *Z. cremnophila*, which are both $2n = 16$. Centric fissions and/or Robertsonian changes, as found in *Z. paucijuga* (Moretti & Sabato, 1984) and *Z. loddigesii* (Vovides & Olivares, 1996), appear to have occurred also in *Z. lacandona*, leading to at least three distinct cytotypes with somatic numbers of 16, 17, and 18. This presents a varying chromosome morphology with 1M +7m + 2msm +1sm + 1st + 4T, 1M + 5m + 3msm + 2sm + 6T, and 2M + 6m + 2sm + 1st

+ 7T, respectively. It appears that centric fissions occur on some of the larger mesocentric chromosomes giving rise to telocentrics with part of the centromere present; thus isochromosomes are formed. According to Lima-de-Faria (1983) these isochromosomes are stable and become easily incorporated into the normal complement. A break in a mesocentric chromosome with elongated kinetochore to form the cytotype $2n = 17$ can easily be envisioned, likewise for the $2n = 17$ cytotype to give rise to $2n = 18$.

Chromosome change is the manifestation of an evolutionary process that may be a response to changing environment. For example, a report on the present-day distribution of chromosome races of the shrew *Sorex araneus* in Great Britain interprets it as a product of colonizing radiations and retreats to refugia associated with climatic changes. In another case, it was found that the number of metacentric chromosomes of the grasshopper *Caledia captiva* increased on one side of a hybrid zone of chromosome races of this species during mesic years and that the number of acrocentrics increased during dry years (King, 1993).

Paratypes. MEXICO. **Chiapas:** Selva Lacandona, July 1984, *Schutzman 510-514* (XAL), *Schutzman 515-520* (XAL), *Schutzman 521-525* (XAL), June 1968, *J. Chavelas P., G. Alanís & M. Martínez ES-3015* (ENCB).

Acknowledgments. We thank the curators and staff of FLAS and XAL for loans and/or access to herbarium materials, which made this study possible, and to Edmundo Saavedra for his superb illustrations, which have always facilitated clear and unambiguous identification. We also thank Bijan Dehgan, Walter S. Judd, and Thomas J. Sheehan for reviews of the manuscript. This article is Florida Agriculture Experiment Station Journal Series No. R-05925.

Literature Cited

King, M. 1993. Species Evolution: The Role of Chromosome Change. Cambridge Univ. Press, New York.

Levan, A., K. Fredga & A. A. Sandberg. 1964. Nomenclature for centromeric position on chromosomes. Hereditas 52: 201–220.

Lima-de-Faria, A. 1983. Molecular Evolution and Organization of the Chromosome. Elsevier, Amsterdam, New York, Oxford.

Miranda, F. 1963. Los tipos de vegetación de México y su clasificación. Bol. Soc. Bot. México 26: 133–176.

Moretti, A. & S. Sabato. 1984. Karyotype evolution by centromeric fission in *Zamia* (Cycadales). Pl. Syst. Evol. 146: 215–223.

Rzedowski, J. 1978. Vegetación de México. Editorial Limusa, Mexico.

Schlarbaum, S. E. & T. Tsuchiya. 1984. The chromosomes of *Cunninghamia konishii, C. lanceolata* and *Taiwania cryptomerioides* (Taxodiaceae). Pl. Syst. Evol. 145: 169–181.

Schutzman, B. 1984. A new species of *Zamia* L. (Zamiaceae, Cycadales) from Chiapas, Mexico. Phytologia 55: 299–304.

———. 1989. A new species of *Zamia* from Honduras. Syst. Bot. 14: 214–219.

———, A. P. Vovides & B. Dehgan. 1988. Two new species of *Zamia* (Zamiaceae, Cycadales) from Southern Mexico. Bot. Gaz. (Crawfordsville) 149: 347–360.

Vovides, A. P. & M. Olivares. 1996. Karyotype polymorphism in the cycad *Zamia loddigesii* (Zamiaceae) of the Yucatan Peninsula, Mexico. Bot. J. Linn. Soc. 120: 77–83.

Three New Species of *Pilocarpus* Vahl (Rutaceae) from Brazil

Ladislau A. Skorupa

Centro Nacional de Pesquisa de Recursos Genéticos e Biotecnologia,
Embrapa/Cenargen, CP 02372, CEP 70.849-970, Brasília, D.F., Brazil

ABSTRACT. As a result of a revision of *Pilocarpus* Vahl (Rutaceae), three new species of *Pilocarpus* Vahl (Rutaceae) from Brazil are described and illustrated: *Pilocarpus alatus* C. J. Joseph ex Skorupa, *Pilocarpus carajaensis* Skorupa, and *Pilocarpus sulcatus* Skorupa. Data on the geographic distribution, habitat, and phenology are given for all the new taxa.

Pilocarpus is a neotropical genus described by Vahl (1797), encompassing shrubs or small trees occurring from the south of Mexico through Central America and the Lesser Antilles and Greater Antilles to the south of South America. The majority of the species occur in Brazil, where they are found in habitats characterized by various climatic conditions, soils, and vegetation types throughout the country.

Skorupa's (1996) revision of *Pilocarpus* recognized 16 species, including three new species in Brazil. This revision took into consideration not only morphology, as did Kaastra (1982), but also wood anatomy, *n*-alkane distribution patterns of foliar epicuticular waxes, chromosome numbers, and pollen morphology as additional sources of taxonomic evidence.

Pilocarpus alatus C. J. Joseph ex Skorupa, sp. nov. TYPE: Brazil. Pará: Peixe Boi, Estação Experimental de Peixe Boi, E. de F. de Bragança, 21 Oct. 1926, *Ducke s.n.* (holotype, RB 20477). Figure 1A–I.

Folia imparipinnata, (2–)3–4(–5)-juga; lamina 3.3–17.0 × 1.5–7.5 cm, anguste elliptica anguste oblonga vel lanceolata, apice acuminato; petiolo cum rhachidi alato. Flores sessiles; calyce lobulis inaequalibus, rotundis vel triangularibus, valvatis; corolla valvata, 6.5–7.0 mm diam., petalis castaneis extus puberulis; filamentis paulo subulatis, apice obtuso; stigmate capitato dilatato, ovario pubescente. Fructus ex 1–5 coccis constans; seminibus nigris.

Shrubs to small trees, 1.5–6.0 m tall; trunk cinereous or brownish, 3.0–5.0 cm diam.; terminal branchlets 3.0–6.0 mm diam., brown or cinereous, glabrous or glabrescent, terminal buds protected by cataphylls, the cataphyll 2.5–4.0 mm long, triangular or oblong, pubescent. Leaves imparipinnate, (2–)3–4(–5)-jugate, alternate, 13.5–35.0 × 8.5–31.0 cm, distance between pairs 2.5–7.0 cm, rachis 4.5–18.5 cm long, pubescent, winged, the wings 0.2–0.4 mm broad, broader toward leaflets; petiole 25.0–90.0 × 1.0–2.0 mm, pubescent above and glabrous beneath, winged, the wings 0.2–0.4 mm broad, the petiole often slightly canaliculate by wings, inserted at ca. 45° (ca. 90° in field); lateral leaflets opposite, the lowermost subopposite, the blade 3.3–17.0 × 1.5–7.5 cm, narrowly elliptic to elliptic, narrowly oblong or lanceolate, acuminate at apex, the acumen 4.0–15.0(–20.0) mm, subacuminate or acute, the base attenuate, acute or obtuse, usually asymmetric, dark green and shining above, paler beneath, chartaceous, the adaxial surface minutely pubescent on midvein or glabrescent, the abaxial surface glabrous, the margin revolute; venation brochidodromous, the midvein prominent on both sides, the secondary veins 12–17 pairs, angle of divergence 65–75°; petiolule 0–2.5 × 1.0–1.5 mm, inserted at 35–45°, pubescent, winged, the wings ca. 0.2 mm broad; terminal leaflet blade 3.0–20.5 × 1.0–9.0 cm, lanceolate or narrowly elliptic, acuminate at apex with acumen to 10.0 mm, or subacuminate, attenuate or acute at base; petiolule 2.0–20.0 × 1.0–1.5 mm, winged, the wings 0.2–0.9 mm broad, frequently tapering toward base, the margin pubescent. Raceme terminal or subterminal, erect, to 25.0 cm long and 6.5–7.5 cm wide at anthesis, the rachis 2.0–3.0 mm thick at base, dark brown, minutely pubescent; bracts at base 2–4, narrowly triangular, ca. 3.5 mm long, pubescent, ferrugineous; flowers sessile, inserted at 90° or slightly inclined toward apex of the raceme; floral bract 1, ca. 0.3 × 0.6 mm, triangular with acute apex, pubescent, ciliolate; bractlets 2, subopposite, 0.3–0.6 × 0.4–0.6 mm, triangular with acuminate apex, pubescent, ciliolate. Calyx (4–)5-lobed, the lobes valvate, joined to middle, unequal, the larger rounded and the smaller triangular with obtuse apex, 0.5–0.9 × 1.3–1.7 mm, pubescent, ciliolate; corolla 6.5–7.0 mm diam., valvate; petals (4–)5, 2.4–2.8 × 2.0–2.2 mm, ovate, pale brown to greenish, pubescent outside, the apex inflexed through

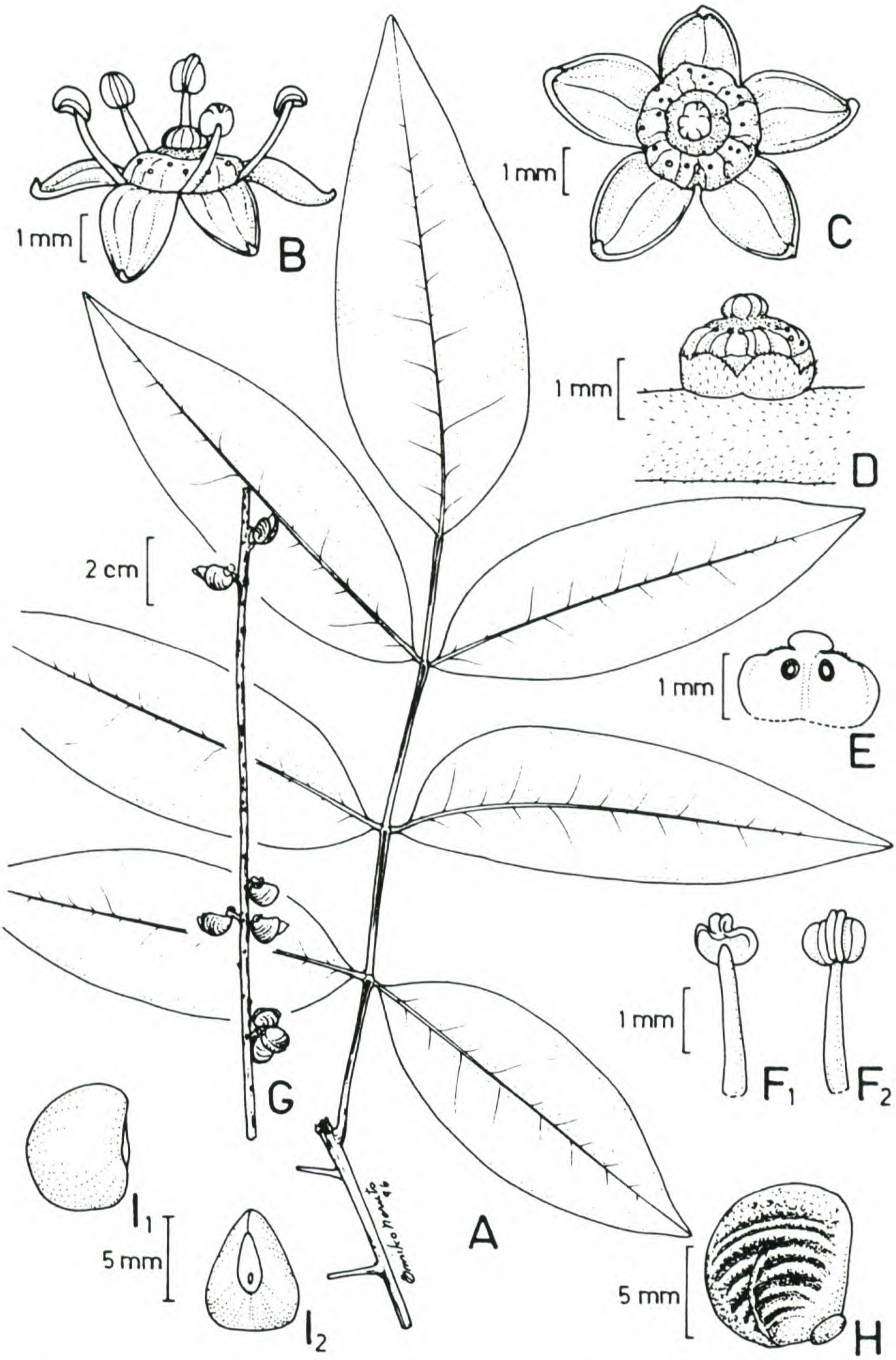


Figure 1. *Pilocarpus alatus* C. J. Joseph ex Skorupa (*Skorupa & Silva 1024*, CEN). —A. General aspect of the branch. —B. Flower, lateral view. —C. Flower, upper view, without stamens. —D. Flower, lateral view, without petals and stamens. —E. Ovary, longitudinal section. —F_1 and F_2. Stamens, dorsal and frontal view. —G. Rachis with mericarps. —H. Mericarp, lateral view. — I_1 and I_2. Seed, lateral and ventral view.

0.3 mm, venation subparallel, the median nerve thicker; stamens (4–)5, filaments 2.1–2.2 × ca. 0.4 mm, flattened, slightly subulate with obtuse apex, glabrous, pale brown, anthers 0.7–0.9 × ca. 0.9 mm, ovate, recurved, with a dorsal narrowly elliptic gland ca. 0.1 mm long, inconspicuous; disk 15-plicate, ca. 0.5 mm high and 2.6–2.8 mm diam., yellowish with conspicuous dark glands, glabrous or puberulent at apex; carpels (4–)5, the ovary ca. 0.7 mm high, 10-plicate, protruding 0.3 mm beyond disk, pale brown, minutely pubescent, with yellowish trichomes; ovule 1 per carpel; style ca. 0.5 mm, protruding ca. 0.1 mm beyond ovary; stigma capitate, dilated, ca. 0.5 × 0.8–1.0 mm, (4–)5-lobate. Mericarps 1–5, 9.0–11.0 × 7.5–9.5 mm, obovoid, dorso-apically rounded to an oblique apex, magenta becoming brownish, pubescent or glabrescent, dark glands inconspicuous, the line of dehiscence reaching to ⅓–⅔ of distance to apex, longitudinally striate from base to apex on both sides, pedicels 1.5–3.0 mm long in fruit; seeds 7.0–7.5 × 5.5–6.0 mm, ellipsoid to ovoid, the testa black, the hilum 2.5–3.5 × 1.1–1.3 mm, ovate to lanceolate.

Phenology. Found with scarce flowering in March; collected in fruit in October and March.

Distribution. Known only from two localities: Lago do Junco in the State of Maranhão and Peixe Boi in the State of Pará, growing in dense forest up to 160 m.

The new species resembles *Pilocarpus microphyllus* Stapf ex Wardleworth, due to its winged rachis, petiolule and petiole alate, and its capitate stigma dilated at the apex. However, *P. microphyllus* differs from *P. alatus* by its smaller leaves and leaflets, the leaflets sessile with an obtuse, rounded and emarginate apex, its pedicellate greenish flowers, subulate filaments, and its reduced and suborbicular anther.

Pilocarpus alatus was published by Joseph (1967) in a magazine called *Mecânica Popular*, which deals generally with scientific curiosities and machine repair. Joseph (1967) presented the new taxon based on *Ducke s.n.*, deposited in RB, with vegetative branches, mericarps, and seeds. Kaastra (1982) did not refer to Joseph's work in his revision of Pilocarpinae, most probably due to the low circulation of the article in research center libraries. For some reason, Kaastra did not have access to the holotype of *P. alatus* and thus did not consider the taxon in his revision. As a consequence, the taxon has remained forgotten for three decades.

The original description of *P. alatus* provides a diagnosis in Latin and designation of the type. However, it conflicts with articles 29.1 and 30.3 of the *International Code of Botanical Nomenclature* (Greuter et al., 1994). According to these articles Joseph's name is not effectively published because it was published in a magazine not distributed to libraries accessible to botanists generally.

Paratypes. BRAZIL. **Maranhão**: Lago do Junco, Fazenda Bacaba, 5 km S from entrance of MA 119, 3 km NW of Lago do Junco, 4°26′S, 44°58′W, 04 Oct. 1980, *Daly et al. 465* (HRB, IAN, SPF); ca. 6 km NW of Lago do Junco, 4°27′S, 44°56′W, 160 m, 20 Mar. 1995, *Skorupa & Silva 1024* (CEN).

Pilocarpus carajaensis Skorupa, sp. nov. TYPE: Brazil. Pará: Parauapebas, Carajás, antigo Zoobotânico, 2.5 km do Aeroporto de Carajás, 5°37′S, 50°37′W, 20 m, 22 May 1992, *L. A. Skorupa & Elzamar 996* (holotype, CEN; isotypes, CEN, G, GH, K, MICH, MO, NY, P, RB, SPF, US). Figure 2A–H.

Folia vulgo simplicia vel unifoliolata raro bifoliolata vel trifoliolata; lamina anguste elliptica, apice acuminato, acumine retuso. Flores virides, breviter pedicellati, pedicellis 0.5–1.5 mm longis, subangulo ca. 45° rhachidi insertis. Fructus plerumque ex coccis 1 vel 2 constans, cocci 9.5–12.0 × 8.0–11.0 mm, paulo complanatis; seminibus vinaceis quasi nigris, 7.5–9.0 × 5.5–7.5 mm.

Shrubs, small trees, or trees, 1.5–7.0 m tall; trunk cinereous, 5.5–7.0 cm diam.; terminal branchlets 2.0–3.5 mm diam., brown or cinereous, glabrescent, terminal buds protected by cataphylls, the cataphyll 1.0–4.0 mm long. Leaves usually simple or unifoliolate, rarely bifoliolate or trifoliolate with 1 or 2 basal leaflets reduced respectively, alternate, subopposite or subverticillate; petiole 3.0–25.0(–38.0) × 1.0–2.5 mm, inserted at 30–55°, glabrous, slightly canaliculate by wings, the wings 0.4–0.6 mm broad; blade 6.0–23.5 × 1.5–6.5 cm, narrowly elliptic, rarely obovate to narrowly obovate or lanceolate, subacuminate or acuminate at apex, the acumen to 23.0 mm long, retuse, the base attenuate to narrowly attenuate, dark green above and paler beneath, chartaceous, glabrous, the margin entire, revolute; venation brochidodromous, the midvein prominent on both sides, the secondary veins 17–20(–24) pairs, angle of divergence 60–75°. Raceme terminal, rarely lateral, pendulous, 17.5–52.0 cm long and 0.7–0.8(–1.2) cm wide at anthesis, the rachis 1.0–3.0 mm thick at base, greenish, pubescent, rarely glabrous; bracts at base 4 or 5, narrowly triangular or falciform, 2.0–6.0 × 0.8–1.5 mm, strigose; pedicels 0.5–1.5 mm long, inserted at ca. 45° to the rachis, glabrous; floral bract 1, 0.4–0.9 × 0.3–0.4 mm, triangular with acuminate apex, glabrous, ciliolate; bractlets 2, subopposite, 0.5–0.8 × 0.5–1.0 mm, triangular

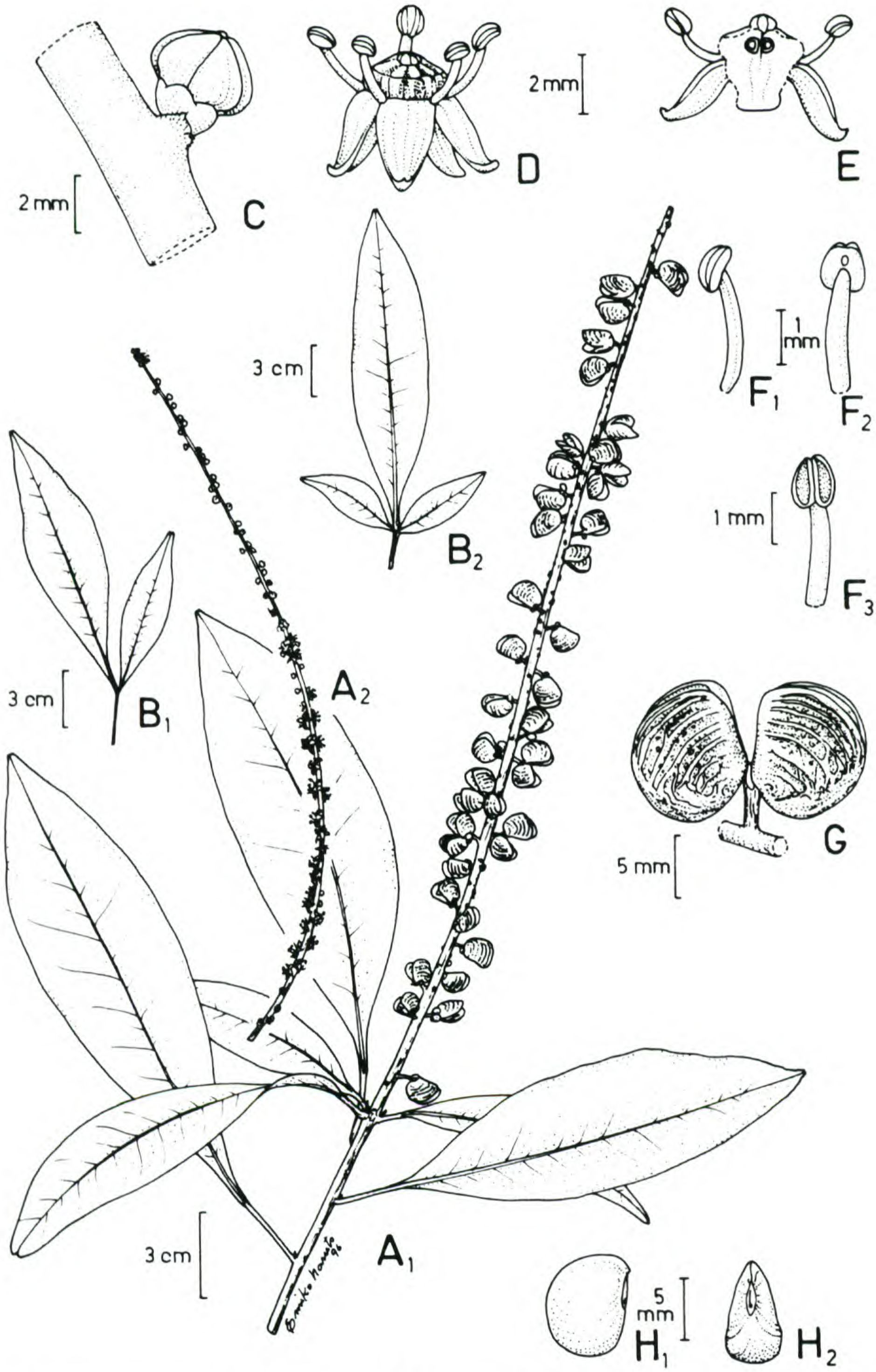


Figure 2. *Pilocarpus carajaensis* Skorupa (*Skorupa & Elzamar 996*, CEN). —A_1. Branch with fruits. —A_2. Inflorescence. —B_1. Bifoliolate leaf. —B_2. Trifoliolate leaf. —C. Bud, lateral view. —D. Flower, lateral view. —E. Flower in longitudinal section. —F_1, F_2, and F_3. Stamens, lateral, dorsal, and frontal view. —G. Mericarps, lateral view. —H_1 and H_2. Seed, lateral and ventral view.

with acuminate apex, glabrous, ciliolate; calyx (4–)5-lobate, the lobes reduced, ovate, 0.4–0.8 × 0.7–1.0 mm, glabrous, ciliolate; corolla 6.0–7.5 mm diam., aestivation quincuncial to subvalvate; petals (4–)5, 2.5–3.1 × 1.5–1.9 mm, lanceolate to ovate, green or yellowish green with dark glands, glabrous, the apex inflexed through 0.3–0.6 mm, venation subactinodromous; stamens (4–)5, filaments 1.9–2.2 × 0.3–0.4 mm, subterete, flattened toward base, the apex obtuse or truncate, glabrous, yellowish green, anthers 1.1–1.3 × 0.8–1.1 mm, recurved, ovate, dorsal gland elliptic or ovate, ca. 0.3 × 0.2 mm; disk 15-plicate, 0.3–0.8 mm high and 1.5–2.6 mm diam., glabrous or with occasional trichomes; carpels (4–)5, the ovary 0.7–0.8 mm high, 5-plicate, protruding 0.2–0.3 mm beyond disk, pale green, glabrous; ovule 1 per carpel; style ca. 0.4 mm inserted among lobes of carpels; stigma capitate, 0.4–0.5 × 0.5–0.8 mm, (4–)5-lobate. Mericarps usually 1 or 2, 9.5–12.0 × 8.0–11.0 mm, obovoid, complanate, dorso-apically rounded to an oblique apex, brown, glabrous with conspicuous brown glands becoming dark, the line of dehiscence reaching to ½–⅔ of distance to apex, pedicels 1.5–4.5 mm long in fruit; seeds 7.5–9.0 × 5.5–7.5 mm, ovate to elliptic, testa vinaceous to black, the hilum 2.3–2.8(–3.4) × 0.5–1.2 mm, lanceolate to narrowly elliptic.

Phenology. Flowering from March to May; collected in fruit from March to July.

Distribution. Restricted to the Carajás region, State of Pará, growing in dense forest up to 500 m.

Evidence of the new taxon was obtained initially through analysis of specimens from IAN and INPA, it being frequently named on labels as *Pilocarpus itacaiunensis.* These specimens were not analyzed by Kaastra (1982), which is somewhat surprising considering that these specimens were collected a long time ago, first in 1948 (*Fróes 23394*), and again in 1949, 1951, 1970, and 1980.

Pilocarpus carajaensis usually has simple or unifoliolate leaves, characterized by the occurrence of a conspicuous articulation at the apex of the petiole, or occasionally bifoliolate or trifoliolate leaves with one or two reduced leaflets, respectively. Bifoliolate and trifoliolate leaves are rare in herbarium specimens, but frequently observed in the field; this anomaly is most probably due to the rarity of such leaves on floral branches, which are usually collected.

Pilocarpus racemosus Vahl also has a great variety of foliar types: simple, unifoliolate, or up to 3-jugate. However, its leaflets usually have an obtuse or rounded (rarely subacuminate) apex. The floral morphology of *P. racemosus* is rather different, with vinaceous to purpureous petals, a clavate stigma and subulate filaments with acute apices, the filaments surrounded at base by a disk. *Pilocarpus racemosus* has an allopatric distribution, occurring from Venezuela up to southern Mexico.

Other taxa that somewhat resemble *Pilocarpus carajaensis* are *P. spicatus* A. Saint-Hilaire var. *spicatus* and *P. peruvianus* (Macbride) Kaastra. *Pilocarpus spicatus* shares with *P. carajaensis* narrowly elliptic leaves with an acuminate apex, greenish flowers with strongly reflexed petals at anthesis, and truncate filaments. However, *P. spicatus* has only simple leaves, pedicels inserted at 90° on the rachis, frequently sessile flowers, and smaller mericarps. *Pilocarpus spicatus* has an allopatric distribution, occurring mainly on the eastern side of Brazil.

Pilocarpus peruvianus also has leaves with an acuminate or eventually retuse apex, greenish flowers with strongly reflexed petals at anthesis, and pedicels inserted at 45° on the rachis. However, this taxon differs from *P. carajaensis* by its always simple leaves with a strongly bullate lamina. Its mericarps are larger with a rounded to semitruncate apex, and its seeds are pale brown. *Pilocarpus peruvianus* has an allopatric distribution, occurring in Peru, Bolivia, and Brazil in Acre, Rondônia, and Mato Grosso States.

The specific epithet "*itacaiunensis,*" coined but not published by J. M. Pires, was not adopted here considering the wider geographic distribution of the taxon in the Carajás region and not only in the vicinity of the Itacaiúnas River as the epithet suggests.

Paratypes. BRAZIL. **Pará**: Altamira, Igarapé Ipixuma, 4°49′S, 52°31′W, 21 Mar. 1986, *Balée 2001* (NY). **Marabá:** Rio Itacaiúnas, entre B2 and B3, 5°31′S, 50°13′W, 09 July 1970, *Pires & Belém 12419* (IAN); Carajás, Serra Norte, 31 May 1983, *Silva et al. 1403* (HRB, MG); entre Caldeirão e Salobro, 29 July 1983, *Silva et al. 1572* (MG); Rio Vermelho, Remansinho, 05 Sep. 1948, *Fróes 23394* (IAC, IAN); região do Tocantins, 23 Apr. 1951, *Fróes 26975* (IAN); área de *Bertholetia,* 01 May 1951, *Fróes 27029* (IAN); Viraçãozinha, 13 June 1949, *Fróes & Black 24472* (IAC, IAN); Parauapebas, Carajás, AMZA 3-alfa, 5°48′S, 50°33′W, 300–475 m, 08 June 1982, *Spelling et al. 5971* (GH, NY); Chácara dos Chagas, 6°04′S, 49°54′W, 22 May 1992, *Skorupa 997* (CEN); Castanhal Jatobal PVF-17, 13 July 1990, *Rosa 5277* (MG); próximo ao N1, 20 May 1982, *Secco et al. 280* (NY); Tucurui, Fazenda Guaripé, 13 May 1980, *Rosa 3668* (INPA, NY). Unknown place: July 1970, *Pires & Belém 12580* (US).

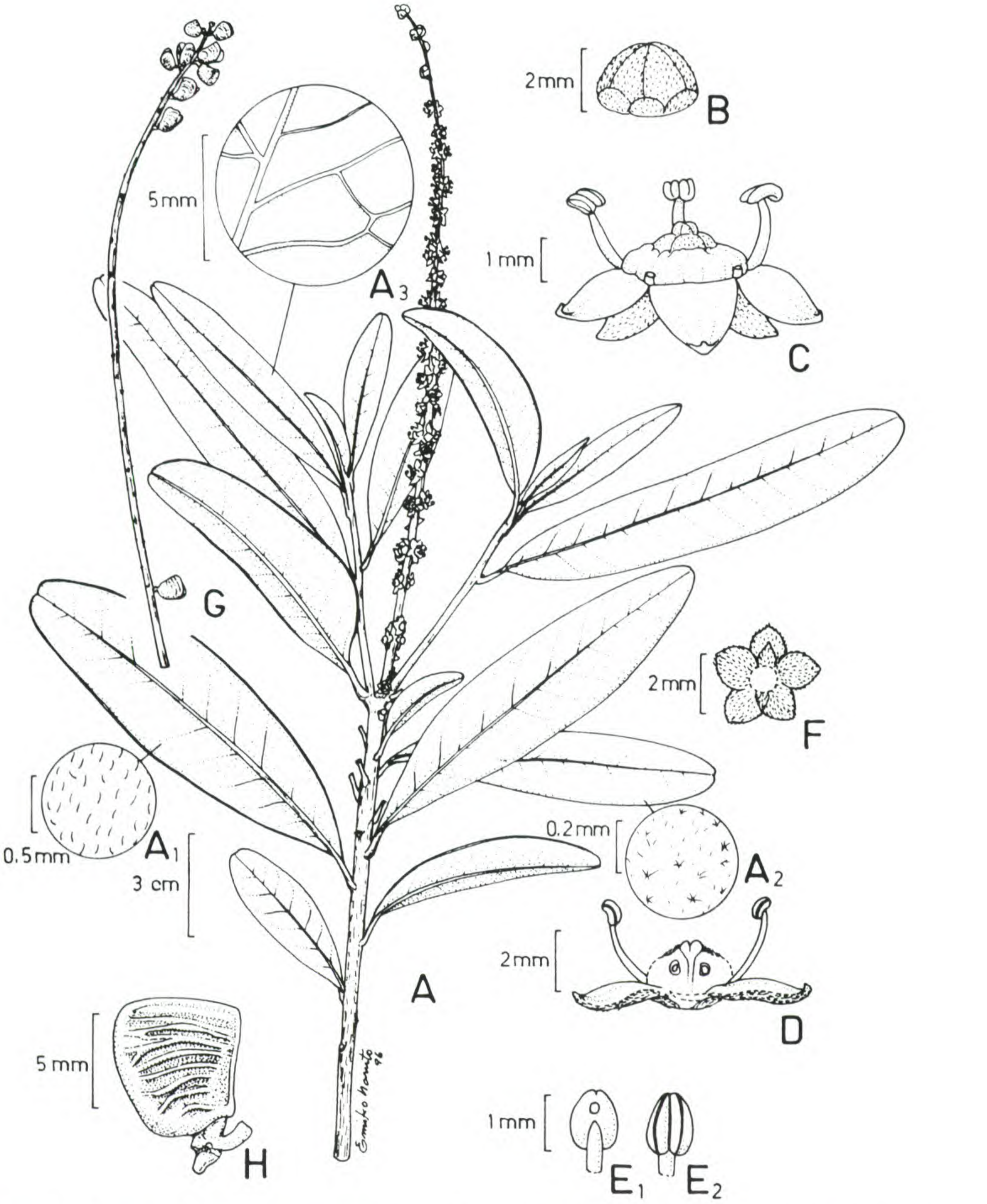


Figure 3. *Pilocarpus sulcatus* Skorupa (*Skorupa 1012*, CEN). —A. Branch of the inflorescence. —A_1. Detail of leaf indument on abaxial surface. —A_2. Detail of leaf indument on adaxial surface. —A_3. Detail of veins with sulcate surface. —B. Bud, lateral view. —C. Flower, lateral view without two stamens. —D. Flower, longitudinal section. —E_1 and E_2. Stamens, dorsal and frontal view. —F. Calyx, lower view. —G. Rachis with mericarps. —H. Mericarp, lateral view.

Pilocarpus sulcatus Skorupa, sp. nov. TYPE: Brazil. Bahia: Tanque Novo, a 10 km de Tanque Novo rumo a São José, no alto da pedreira (ca. 1 km), 13°32′S, 42°29′W, alt. 835 m, 16 Mar. 1994, *L. A. Skorupa 1012* (holotype, CEN; isotypes, CEN, K, MICH, MO, NY, RB, SPF). Figure 3A–H.

Folia simplicia; lamina 3.0–12.5 × 1.0–6.0 cm, anguste elliptica vel anguste oblonga vel subinde oblanceolata, subtus dense pubescente, supra glabra vel nervo medio marginibusque pubescentibus, supra nervis conspicue sulcatis. Flores subsessiles; corolla 6.0–8.0 mm diam.; calyce lobulis extus strigulosis; petalis castaneis extus pubescentibus. Fructus plerumque ex cocco unico constans; cocco 5.5–8.0 × 5.5–7.5 mm.

Shrubs to small trees, 1.0–4.0 m tall; trunk cinereous, 4.0–6.0 cm diam., branched near base; terminal branchlets 3.5–6.0 mm diam., cinereous or slightly vinaceous, pubescent or glabrous, terminal buds protected by cataphylls, the cataphyll 2.5–5.0(–10.0) mm long, narrowly triangular to narrowly oblong, strigose, ferrugineous. Leaves simple, alternate or subverticillately crowded toward apex of branchlets; petiole 3.0–10.0(–14.0) × 1.0–2.0 mm, inserted at 35–55°, pubescent, slightly winged, the wings up to 0.3 mm broad; blade 3.0–12.5 × 1.0–6.0 cm, narrowly elliptic or narrowly oblong or oblanceolate, the apex rounded, obtuse, or emarginate, the base attenuate, dark green above and paler beneath, opaque, subcoriaceous, the adaxial surface glabrous or pubescent at margins and along midrib, the abaxial surface pubescent, the margin entire, strongly revolute; venation brochidodromous, the veins with sulcate surface on adaxial side, prominent on abaxial side, the secondary veins 11–15 pairs, angle of divergence 45–55°. Raceme terminal, erect, 9.0–18.0(–33.0) cm long and 0.7–0.8 cm wide at anthesis, the rachis 1.5–3.0 mm thick at base, strongly pubescent, the trichomes ferrugineous or paler; bracts at base caducous, occasionally persistent, triangular, ca. 1.5 × 3.0 mm, pubescent, ferrugineous; pedicels 0.2–0.5 mm long, inserted at 90° to the rachis or slightly inclined toward apex of raceme, pubescent; floral bract 1, 0.6–1.0 × 0.4–1.0 mm, triangular with acute apex, strigillose, ciliolate; bractlets 2, subopposite, 1.0 × 0.9 mm, triangular with acuminate apex or widely ovate, strigillose, ciliolate; calyx 5-lobed, the lobes separate, quincuncial, 0.8–1.4 × 1.1–1.6 mm, unequal, ovate to widely ovate, rounded or obtuse at apex, strigillose and ciliolate; corolla 6.0–8.0 mm diam., subvalvate; petals 5, 2.5–3.0 × 2.0–2.4 mm, ovate to broadly ovate, coriaceous, nut-brown, densely pubescent outside, the apex inflexed through 0.5–0.6 mm, venation subparallel; stamens 5, filaments 2.8–2.9 × ca. 0.3 mm, flattened, ± subulate with apex acute or obtuse, glabrous, pale brown, anthers 0.9–1.0 × 0.7–0.8 mm, ovate or elliptic, the dorsal gland suborbicular, 0.3–0.4 × 0.2–0.3 mm; disk 0.8–1.0 mm high and 3.0–3.2 mm diam., glabrous; carpels 5; ovary 1.2–1.4 mm high, protruding ca. 0.4 mm beyond disk, strigillose, the trichomes ferrugineous or paler; ovules 1 per carpel; style ca. 0.5 mm; stigma capitate, 0.6–0.7 × 0.7–0.8 mm, 5-lobate. Mericarps 1 or rarely 2, 5.5–8.0 × 5.5–7.5 mm, obovoid, dorso-apically rounded or apex semitruncate, pubescent, vinaceous glands becoming dark, line of dehiscence reaching to ¼ of distance from apex; pedicels ca. 1.5 mm long in fruit; seeds not seen.

Phenology. Flowering specimens collected from March to June and fruiting specimens from January to March.

Distribution. Relatively restricted, this species occurs in southern Bahia and northern Minas Gerais, on lateritic soils from 520 to 850 m.

Pilocarpus sulcatus differs from other taxa by some remarkable features, the first of them being the conspicuously sulcate veins on the adaxial leaf surface, a character only slightly developed in *P. riedelianus* Engler and *P. trachylophus* Holmes. Its flowers have densely pubescent calyces and corollas, and the leaves are pubescent on the abaxial surface and frequently also on the margins and midrib on the adaxial surface. *Pilocarpus spicatus* A. Saint-Hilaire subsp. *longeracemosus* (Martius ex Engler) Kaastra has a similar pilosity, but it has greenish flowers with conspicuous pedicels and filaments subulate with an acute apex.

Unlike any other species in the genus, *P. sulcatus* has a great capacity for vegetative propagation, characterized by stolon-like organs that run horizontally and shallowly under the soil surface, resulting in numerous shoots of the same plant.

Paratypes. BRAZIL. **Bahia**: Caetité, near Caetité, 01 Mar. 1983, *Guedes 2905* (SP); 13°54′S, 41°25′W, 13 Mar. 1981, *Silva 194* (HRB, RB); Ituaçu, Morro da Mangabeira, 13°50′S, 41°18′W, 520 m, 20 June 1987, *Queiroz et al. 1593* (SPF). **Minas Gerais**: Espinosa, 7 km E of Monte Azul, 850 m, 29 Jan. 1991, *Taylor et al. 1488* (SPF).

Acknowledgments. I gratefully acknowledge the Cia. Vale do Rio Doce in Carajás, State of Pará, and Mrs. Elzamar, curator of the local herbarium, for support given during the collection of *P. carajaensis* in that reserve; Manoel Andrade Neto for valuable information about *P. sulcatus* in the State of Bahia; and José Rubens Pirani for his valuable advice during the revision of *Pilocarpus*. The illustrations are by Emiko Noruto.

Literature Cited

Greuter, W., F. R. Barre, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva & P. Trehane. 1994. International Code of Botanical Nomenclature (Tokyo Code). Regnum Veg. 131.

Joseph, C. J. 1967. Revisão sistemática do gênero *Pilocarpus* (spp. *brasileiras*). Mecânica Popular. Outubro: 1–9.

Kaastra, R. 1982. Pilocarpinae. Flora Neotropica 33: 1–200.

Skorupa, L. A. 1996. Revisão taxonômica de *Pilocarpus* Vahl (Rutaceae). Doctoral Thesis, University of São Paulo, São Paulo, Brazil.

Vahl, M. 1797. Eclogae americanae seu descriptiones plantarum praesertim Americae Meridionalis nondum cognitarum 1: 1796–1807. København.

A New Variety of *Pedicularis longiflora* (Scrophulariaceae) from Northwest Sichuan, China

Tang Ya
Herbarium, Chengdu Institute of Biology, Chinese Academy of Sciences, P.O. Box 416, Chengdu, Sichuan 610041, People's Republic of China

Lazarus Walter Macior
Department of Biology, The University of Akron, Akron, Ohio 44325-3908, U.S.A.

Zhang Jian-chen
Herbarium, Sichuan Grassland Research Institute, Hongyuan, Sichuan 624400, People's Republic of China

ABSTRACT. *Pedicularis longiflora* Rudolph var. *hongyuanensis* Y. Tang is described, and the characters that distinguish it from the other varieties of *P. longiflora* are discussed.

During the summer of 1996 field research was carried out in Hongyuan County, northwest Sichuan Province (China), to study the pollination ecology of various *Pedicularis* species. Field observations were made near the town of Hongyuan along highway 213, which connects Sichuan and Gansu provinces. In addition to the new variety (*P. longiflora* var. *hongyuanensis*) herein described, the following 18 species or infraspecific taxa were found: *P. alashanica* Maximowicz, *P. bidentata* Maximowicz, *P. cranolopha* Maximowicz, *P. davidii* Franchet, *P. ingens* Maximowicz, *P. kansuensis* Maximowicz, *P. lasiophrys* Maximowicz, *P. longiflora* var. *tubiformis* (Klotzsch) Tsoong, *P. oederi* var. *sinensis* (Maximowicz) Hurus, *P. plicata* Maximowicz, *P. polyodonta* Li, *P. rhinanthoides* subsp. *labellata* (Jacquin) Tsoong, *P. semitorta* Maximowicz, *P. spicata* Pallas, *P. stenocorys* Franchet, *P. verticillata* L., and *P. violascens* Schrenk.

Species of *Pedicularis* varied in their habitat preferences and population size. For example, *P. verticillata* was very common in the study area, and it grew in damp and dry sites. In contrast, *P. longiflora* var. *tubiformis* and *P. oederi* var. *sinensis* grew in moist meadows, *P. rhinanthoides* subsp. *labellata* was restricted to dry meadows, and *P. semitorta* was almost always among shrubs of *Spiraea alpina*. Species association in a given area ranged from six to nine. Except for *P. oederi* var. *sinensis*, which was in fruit during the duration of fieldwork, plants of all other taxa were in full flower.

In every research site, all *Pedicularis* species were easily within the flight range of a given pollinator. However, no putative hybrids were found. This agrees with the field observations of one of us (Macior) from other parts of the world. It appears, therefore, that geographic isolation among *Pedicularis* species may be less important than pollinator behavior in the prezygotic reproductive isolation. Population size in *Pedicularis* appears to be related to the availability of microhabitats, which seem to play an important role in speciation within the genus.

Pedicularis longiflora Rudolph var. **hongyuanensis** Y. Tang, var. nov. TYPE. China. Sichuan: Hongyuan County, near Waqie (29 km from Hongyuan town), dry slope meadows, ca. 3450 m, July 1996, *Tang Ya, L. M. Macior & Chen Jianzhong 9622* (holotype, CDBI).

Herba perennis humilis, 10–15 cm alta. Radix teres, ad 5–8 cm longa, carnosa. Caules saepe 3–5, caespitosi. Folia basalia et caulinaria petiolata, petiolis 3–5 cm longis, complanatis, basi membranaceis leviter dilatatis vaginatisque, margine pilosis; lamina linearis usque lanceolata, 4–8 cm longa, pinnatisecta, segmentis 10–18-jugis, margine duplicato-serratis, saepe leviter revolutis, glabra. Flores axillares; pedicelli 8–12 mm longi. Calyx cylindrico-campanulatus, 14–17 mm longus, pilis obtectis. Corolla flava, tubus 6.5–9.2 cm longus.

Perennial herbs, 10–15 cm tall. Taproot cylindric, 5–8 cm long, with several fibrous roots. Stems usually 3–5, caespitose. Leaves basal and cauline, basal ones densely fascicled; petiole 3–5 cm on basal leaves, 2–3.5 cm on cauline ones, sparsely pubescent or glabrate, lower part membranous, swollen, sparsely ciliate; leaf blade linear or lanceolate, 4–8 cm long, pinnately lobed or parted;

lobes rounded-dentate or linear, 10–18, glabrous, adaxially purple when dry, abaxially brown, margin denticulate, sometimes double serrate, slightly reflexed. Flowers axillary. Pedicel 0.8–1.2 cm long. Calyx tubelike, 1.4–1.7 cm excluding teeth, exterior hairy, dense in the lower part; teeth 2–3 mm long. Corolla yellow adaxially, yellowish abaxially; tube 6.5–9.2 cm long; lower lip glabrous or sparsely long ciliate, ca. 22 mm wide, ca. 15 mm long, with 3 red spots; middle lobe obovate to orbicular, 6–8 mm long, apex rounded or obtuse; lateral lobes oblong to orbicular, ca. 16 mm long, with two red spots. Galea S-shaped, extending outward, with a single red spot. Filaments villous. Style exceeds galea. Fruits unknown.

This new variety is common in the slope meadows on the way from Tangke to the county town of Zoige County and in the meadows near Longriba of Hongyuan County.

Pedicularis longiflora var. *hongyuanensis* differs from variety *longiflora* in having longer (3–5 vs. 1–2 cm) petioles, 10–18 vs. 5–9 lateral leaf lobes, pilose instead of ciliate calyces, and obtuse instead of emarginate apices of the middle and lateral lobes of the petals. The most striking difference is the presence in variety *hongyuanensis* of three red spots on the lower lip, one on the upper lip, and two on the lateral sides. In variety *longiflora* the corolla is not spotted or the number of red spots is different.

Pedicularis longiflora var. *hongyuanensis* differs from variety *tubiformis* (Klotzsch) P. C. Tsoong in having three instead of two red spots on the lower lip, a larger (ca. 1.5 × 2.2 vs. 1.1–1.2 × 2 cm) lower lip with an orbicular and obtuse to rounded instead of square and emarginate middle lobe, and a yellowish instead of dark yellow corolla abaxially. The two varieties also grow in different habitats. Variety *hongyuanensis* grows on sloping land and hillsides that are usually dry, whereas variety *tubiformis* always occurs in *Kobresia* meadows that are always damp.

Paratypes. CHINA. **Sichuan:** Hongyuan County, near Hongyuan town, *Tang Ya, L. W. Macior & Chen Jianzhong 9608* (CDBI); roadside from Longriba to Shujinshi, *Tang Ya, L. W. Macior & Chen Jianzhong 9697* (CDBI).

Acknowledgments. We are grateful to the Eppley Foundation for Research, Inc., Chengdu Institute of Biology, and the Chinese Academy of Sciences for funding. We thank Chen Jianzhong (Chengdu Institute of Biology) and Dong Zhaolin (Sichuan Grassland Research Institute) for field assistance, and Ihsan Al-Shehbaz (Missouri Botanical Garden) for help with the manuscript.

A New Species of *Lobelia* (Campanulaceae) from Brazil

Ana Odete Santos Vieira and G. J. Shepherd*
Departamento de Botânica, Universidade Estadual de Campinas, CxP 6109, 13083-970, Campinas, São Paulo, Brazil.
*Permanent address: Departamento de Biologia Animal e Vegetal, Universidade Estadual de Londrina, CxP 6001, 86051-990, Londrina, Paraná, Brazil;
E-mail: aovieira@npd.uel.br

ABSTRACT. *Lobelia brasiliensis*, a new species of subsection *Haynaldianae* F. E. Wimmer (of *Lobelia* L. sect. *Rhynchopetalum*), is described from Brazil. It is distinguished from related Brazilian species by its yellowish puberulous abaxial leaf surface and the smaller dimensions of its floral structures. This species also has a different flowering period and is isolated geographically.

The genus *Lobelia* was established by Linnaeus (1753) in *Species Plantarum*. *Lobelia* is included in the family Campanulaceae Jussieu (Cronquist, 1981), subfamily Lobelioideae Burnett (Burnett, 1835; Wimmer, 1943), considered by some authors to be the separate family Lobeliaceae R. Brown (Dahlgren, 1980; Heywood, 1993; Hutchinson, 1973). This genus is distinguished by a dorsal slit that reaches the corolla base and by the fruit, which is a capsule that dehisces by two valves. This genus is widespread in the tropics, with centers of diversity in tropical Africa and Mexico. *Lobelia* L. is estimated to contain about 450 species (Wimmer, 1953, 1968) and is represented in Brazil by two subgenera: subg. *Lobelia* (6 species), delicate prostrate or erect herbs up to 1 m; and subg. *Tupa* (G. Don) F. E. Wimmer (10 species), erect herbs with hollow stems up to 4 m tall at flowering (Braga, 1956; Kanitz, 1878).

During a study of Brazilian lobelias, a new species was recognized in subgenus *Tupa*. This new taxon belongs to section *Rhynchopetalum* (Fresenius) Bentham, subsection *Haynaldianae* F. E. Wimmer (Mabberley, 1974). The new species is described and illustrated here.

MATERIAL AND METHODS

This study was based on herbarium material borrowed from the herbaria cited in the material examined and on observations of plants in their natural habitats.

RESULTS AND DISCUSSION

Lobelia brasiliensis A. O. S. Vieira & G. J. Shepherd, sp. nov. TYPE: Brazil. Distrito Federal: Brasilia a Taguatinga, 12 Sep. 1964, *Prance & Silva 59034* (holotype, UB; isotypes, M, NY, RB, S, US). Figure 1.

Inter species brasilienses subsection *Haynaldianae* F. E. Wimmer, foliis supra glabris, subtus puberulis, 14–29 cm longis, 2.5–6 cm latis; pedicello sigmoideo, puberulo, 12–35 mm; corolla extus puberula et intus puberula vel tantum adest in parte inferiore, ca. 2–4 cm longa; hypanthio puberulo; seminibus late alatis differt.

Plant 1.5–4 m tall, with white latex. Stem terete, fistulose, glabrous. Leaves narrowly oblong or narrowly elliptic-lanceolate, 14–29 cm long, 2.5–6 cm wide; apex acuminate, base narrowly cuneate and decurrent, margin minutely serrate or dentate, chartaceous, adaxially glabrous, abaxially puberulous with yellowish indument; secondary veins 14–26 pairs forming an angle of 45°–60° with the midrib. Inflorescence a terminal raceme, up to 1.5 m, with smaller secondary basal racemes, all puberulous on the rachis. Bracts deflexed, lanceolate, 17 mm long, 3 mm wide, acute, margin entire and ciliate, decurrent, and connate to pedicels, puberulous. Pedicel terete, sigmoidal ascending, 12–35 mm long, puberulous. Calyx with triangular sepals, 3–4 mm wide at the base and 15–17 mm long, acute, margin entire, puberulous. Dorsal corolla lobes 21–39 mm long and 0.5–1.5 mm wide, ventral lobes 10 mm long and 1.5–2.5 mm wide; puberulous on both faces or only on the lower third of the internal face, indument yellowish. Stamens with filaments 25 mm long, puberulous; anthers 6–8 mm long, glabrous, grayish. Hypanthium campanulate, 3–5 mm long and 5–9 mm wide, puberulous, indument yellowish. Capsule ovoid, ⅓–⅔ free from the hypanthium, 10–12 mm long, 20–25 mm wide; sepals 3–4 mm wide and 20–35 mm long; bract 25 mm long, pedicel 20–25 mm long.

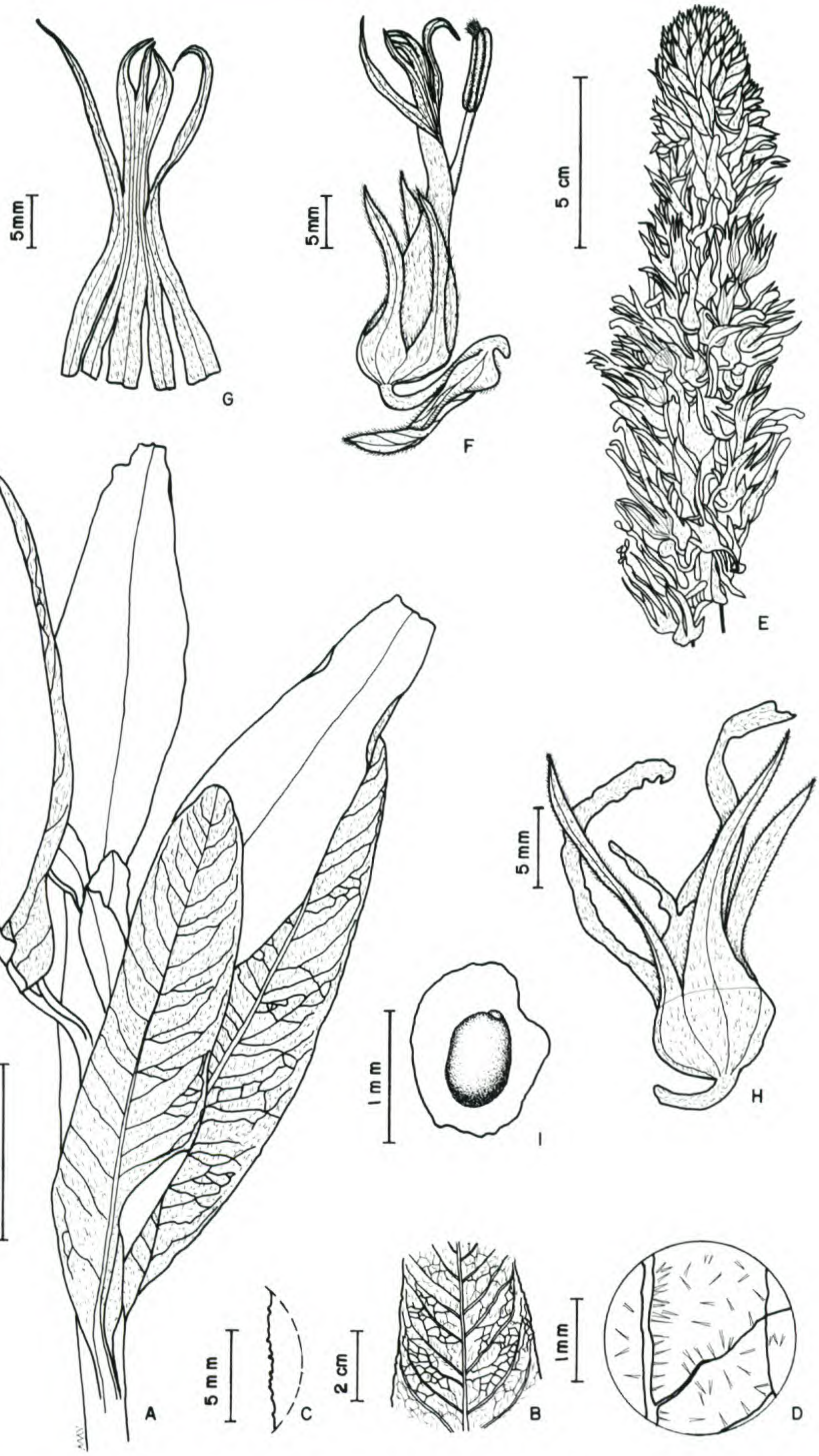


Figure 1. *Lobelia brasiliensis* A. O. S. Vieira & G. J. Shepherd. —A. Shoot with leaves. —B. Leaf with nervation. —C. Detail of margin of leaf. —D. Indument on abaxial surface. —E. Inflorescence. —F. Flower and bract. —G. Corolla open, internal face. —H. Fruit. (A–H *Silva s.n.*, RB 162862.) —I. Seed (*Heringer et al. 254*).

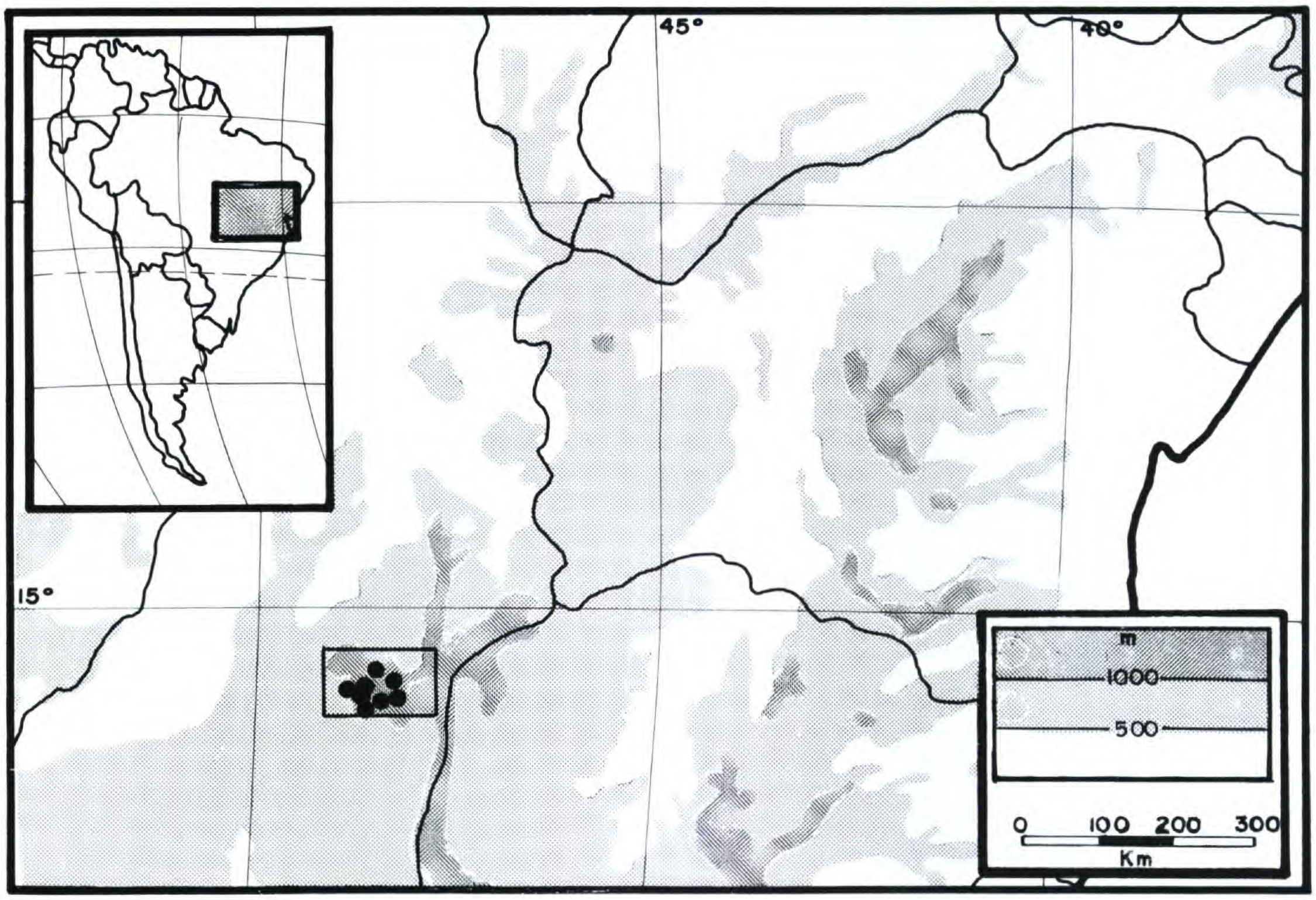


Figure 2. Geographic distribution of *L. brasiliensis*.

Seed lenticular, suborbicular, yellow and finely reticulate, 1.2 mm long, 1.0 mm wide, with seed body 0.8 mm long and 0.3 mm wide, surrounded by a broad (0.1–0.4 mm) wing.

Etymology. The specific epithet is a reference to Brazil, since this species is endemic and occurs around the capital, Brasília.

Taxonomic remarks. This species appears to be close to *Lobelia thapsoidea* Schott (Schott, 1831), which occurs predominantly in the state of Rio de Janeiro, but differs in its narrowly winged seeds and lack of yellowish indument. The broadly winged seeds also show similarities to *L. organensis* Gardner, but this species has glabrous leaves (Gardner, 1845). Scanning electron microscope (SEM) observations show that in the present species the seed coat has much thicker cell walls, the thickest observed in all of the Brazilian lobelias. The yellowish indument concentrated on floral structures and the smaller dimensions of its leaves and flowers are also distinctive among the Brazilian species of this section.

Distribution and habitat. *Lobelia brasiliensis* is geographically isolated from the remaining species of the subsection. Its distribution area is concentrated in the Distrito Federal (Fig. 2), in moist places near riparian forests and "cerrados" (Brazilian savannas) or open spaces; 700–1175 m.

Flowering and fruiting. The majority of individuals flower in spring (September–November), and the remaining Brazilian species flower in summer or winter.

Paratypes. BRAZIL. **Distrito Federal:** Brasília, *Irwin & Soderstrom 6119* (UB); Colégio Agrícola de Brasília, Rio Parnaíba, *Mattos Filho & Heringer 350* (RB); Colégio Agrícola, *Pires & Mattos 9864* (UB); Córrego do Zoológico, *Lima 22* (UB); Zoobotânico, *Sucre 483* (UB); Córrego Samambaia, *Irwin et al. 8157* (UB); Fundação Zoobotânica, *Pires et al. 9516* (F not seen, RB, UB); RECOR R.2, 1978, *s. col. 609* (UEC); RECOR R.2, *Heringer et al. 204* (UEC); RECOR R.7, *Heringer et al. 254* (UEC); Brasília Rio Torto, *Irwin et al. 18065* (UB); Rodovia 3, *Allen et al. 394* (RB); Universidade de Brasília, Campo Olímpico Lagoa Paranoá, 15°46′S, 47°51′W, *Plowmann 10000* (F not seen, NY, MBM); Cerrado 3 km da Rodoviária, *Silva s.n.* (RB 162862); Sobradinho, *Heringer 13223* (HB, UB); 4 km Vargem Bonita, rodovia para Brasília, *Ratter et al. 4355* (E); 5 km S de Brasília para Belo Horizonte, Rio Gama, *Irwin et al. 8529* (UB); Reserva Ecológica do IBGE, *Pereira Neto 55* (UEC); Final da Asa Norte, *Rocha s.n.* (FUEL 11115).

Acknowledgments. The study of this new taxon is a part of A. O. S. Vieira's MSc. dissertation at Universidade Estadual de Campinas, partly sponsored by a grant from CAPES (Coordenação de

Aperfeiçoamento de Pessoal de Nível Superior). We thank the herbaria mentioned for the loan of material, Maria Augusta Santos Vieira for the illustrations, Volker Bittrich for commenting on a draft of this paper, P. Josafá C. de Siqueira SJ for verifying the Latin diagnosis, and Daniela Zappi for helping to locate Burnett's book in the Library of the Royal Botanic Gardens, Kew.

Literature Cited

Braga, R. E. 1956. Lobelias do Brasil—Contribuição para o seu estudo. Arquivos de Biologia e Tecnologia 11: 21–94.

Burnett, G. T. 1835. Campanulaceae. Pp. 941–942 *in:* Outlines of Botany. Henry Renshaw, London.

Cronquist, A. 1981. Campanulaceae. Pp. 300–303 *in:* An Integrated System of Classification of Flowering Plants. Columbia Univ. Press, New York.

Dahlgren, R. M. T. 1980. Campanulaceae and Lobeliaceae *in:* A revised system of classification of the angiosperms. J. Linn. Soc., Bot. 80: 91–124.

Gardner, G. 1845. Contributions towards a flora of Brazil. J. Bot., Lond. 4: 128–129.

Heywood, V. H. 1993. Campanulaceae and Lobeliaceae. Pp. 254–256 *in:* Flowering Plants of the World, 2nd ed. Oxford Univ. Press, New York.

Hutchinson, J. 1973. Campanulaceae and Lobeliaceae. Pp. 586–594 *in:* The Families of Flowering Plants, 3rd ed. Clarendon Press, Oxford.

Kanitz, A. 1878. Lobeliaceae. *In:* C. F. P. von Martius, Flora Brasiliensis 6(4): 130–187. Frid. Fleischer, Leipzig.

Linnaeus, C. 1753. *Lobelia.* Pp. 929–933 *in:* Species Plantarum, vol. 2. The Ray Society, London.

Mabberley, D. J. 1974. The pachycaul Lobelias of Africa and St. Helena. Kew Bull. 29: 535–584.

Schott, 1831. V. II. *Lobelia.* Pp. 102 T. 167 *in* J. B. E. Pohl, Plantarum Brasiliae icones et descriptiones, Wien.

Wimmer, F. E. 1943. Campanulaceae–Lobelioideae. V. I. Pp. 1–260 *in* A. Engler, Das Pflanzenreich. IV. 276b. Akademie Verlag, Berlin.

———. 1953. Campanulaceae–Lobelioideae. V. II. Pp. 261–813 *in* A. Engler, Das Pflanzenreich. IV. 276b. Akademie Verlag, Berlin.

———. 1968. Campanulaceae–Lobelioideae. Supplementum. Pp. 814–1024 *in* A. Engler, Das Pflanzenreich. IV. 276c. Akademie Verlag, Berlin.

Humiles, a New Section of *Pleione* (Orchidaceae)

Guanghua Zhu
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Shingchi Chen (Xinqi Chen)
Laboratory of Systematic and Evolutionary Botany, Institute of Botany,
Chinese Academy of Sciences, Nanxinchun 20, Xiangshan,
Beijing 100093, People's Republic of China

ABSTRACT. Two sections in the genus *Pleione* D. Don are recognized here. The acceptance of *Pleione praecox* as the lectotype of the generic name *Pleione* (J. E. Smith) D. Don makes *Pleione* sect. *Dictyopleione* synonymous with *Pleione* sect. *Pleione*. A new name, *Pleione* sect. *Humiles* G. Zhu & S. C. Chen, is proposed for the other section represented by *P. humilis* (J. E. Smith) D. Don, which is described here. A key to sections and a list of currently recognized species of the genus are provided.

Pleione D. Don (Orchidaceae, Coelogyneae) is a small genus of great beauty. Nineteen species are currently recognized, occurring from the Qinling Mountains in central China, southeast to Taiwan, southwest to the Himalayas, and south to northern Thailand, Laos, and Vietnam in subtropical Asia. They grow in a wide variety of usually well drained habitats, on tree trunks, woody slopes, and on rocks and cliffs covered with mosses, occurring at altitudes from 600 to 4200 m. The plants are of great horticultural importance, because they all have one showy flower and are easy to cultivate and propagate by vegetative means. There have been many artificial hybrids reported in recent years. There are also modern revisions of this economically important genus (Cribb et al., 1983; Cribb & Butterfield, 1988). The present paper deals with an unresolved nomenclatural problem of the sections in the genus.

Pleione was established by David Don (1825) based on two Himalayan species previously described by James E. Smith, namely *Epidendrum praecox* and *E. humile*. However, there was no indication of a type species. Half a century later, Ludovicus Pfeiffer (1874) cited the species *Epidendrum praecox* J. E. Smith after the generic name *Pleione*. According to his introductory comments at the start of the work, Pfeiffer used this method to indicate types, and the species *Pleione praecox* (J. E. Smith) D. Don is here accepted as the lectotype of the generic name *Pleione*. Subsequently, in Engler's *Das Pflanzenreich*, Ernst Pfitzer recognized 13 species of *Pleione*, which he placed in two sections: section *Eupleione* with 8 species and section *Dictyopleione* with 5 (Pfitzer & Kraenzlin, 1907). Unaware of Pfeiffer's earlier typification, Pfitzer placed *P. praecox* in his section *Dictyopleione*, and *P. humilis* (J. E. Smith) D. Don in section *Eupleione*. No type was designated for either sectional name. Until recently, this confusion of typification has puzzled some modern authors. For example, both *P. praecox* and *P. humilis* have been considered as types of the genus *Pleione* (Cribb et al., 1983; Cribb & Butterfield, 1988).

The two sections in *Pleione* are well defined and widely accepted. According to the *International Code of Botanical Nomenclature* (Greuter et al., 1994, Article 22.1), a name of any subdivision of a genus that includes the type of the adopted, legitimate name of the genus to which it is assigned is to repeat that generic name unaltered as its epithet. Therefore, the acceptance of Pfeiffer's designation of *Pleione praecox* as the lectotype of the name *Pleione*, as by the *Index Nominum Genericorum* (Farr et al., 1979), automatically makes *Pleione* sect. *Dictyopleione* synonymous with *Pleione* sect. *Pleione*. This section, represented by *P. praecox*, includes the autumn-flowering species. The other section, typified by *P. humilis*, includes the spring-flowering species. The name *Pleione* sect. *Humiles* G. Zhu & S. C. Chen is here proposed for the latter section.

The current nomenclature and taxonomy of the genus *Pleione* may be summarized as follows:

Pleione D. Don, Prodr. Fl. Nepal. 36. 1825. TYPE: *Pleione praecox* (J. E. Smith) D. Don, Prodr. Fl. Nepal. 37. 1825 [*Epidendrum praecox* J. E. Smith, Exot. Bot. 2: 73. 1806], (lectotype, designated by Pfeiffer (1874: 754)).

Pleione sect. **Pleione**

Pleione sect. *Dictyopleione* Pfitzer & Kraenzlin, in A. Engler, Das Pflanzenreich (IV. 50. II B. 7): Coelogyninae, 121. 1907. Nom. superfl.

1. **Pleione lagenaria** Lindley in Paxt., Fl. Gard. 2: 5. t.39. 1851. India (Assam).

2. **Pleione maculata** (Lindley) Lindley, Paxt., Fl. Gard. 2: 5. t. 39. 1851. Bhutan, Myanmar, China (Yunnan), India (Assam and Manipur), Sikkim, Nepal, and Thailand.

3. **Pleione praecox** (J. E. Smith) D. Don, Prodr. Fl. Nepal. 37. 1825. Bhutan, Myanmar, China (Yunnan and Xizang), N India, Nepal, and Thailand.

4. **Pleione saxicola** T. Tang & F. T. Wang ex S. C. Chen, Acta Phytotax. Sin. 25(6): 473, fig. 1. 1987. China (Yunnan).

Pleione sect. **Humiles** G. Zhu & S. C. Chen, sect. nov. TYPE: *Pleione humilis* (J. E. Smith) D. Don, Prodr. Fl. Nepal. 37. 1825.

Pseudobulbis ovoideis vel ampulliformibus, unifoliis, vere florens.

Flowering in spring; pseudobulbs ovoid to flask-shaped, narrowed gradually at the apex, 1-leaved (2-leaved in *P. scopulorum*), never mottled or warted; basal sheaths of the inflorescence smooth.

5. **Pleione albiflora** Cribb & C. Z. Tang, Curtis's Bot. Mag. 184: 117. 1983. Myanmar, China (Yunnan).

6. **Pleione bulbocodioides** (Franchet) Rolfe, Orchid Rev. 11. 291. 1903. China (Anhui, Gansu, Guangdong, Guangxi, Guizhou, Sichuan, Yunnan, and Xizang).

7. **Pleione chunii** C. L. Tso, Sunyatsenia 1: 148. 1933. China (Guangdong and Yunnan).

8. **Pleione confusa** Cribb & C. Z. Tang, Curtis's Bot. Mag. 184: 126. 1983. China (Yunnan).

9. **Pleione coronaria** Cribb & C. Z. Tang, Curtis's Bot. Mag. 184: 123. 1983. Nepal.

10. **Pleione formosana** Hayata, J. Coll. Sci. Univ. Tokyo 30, art. 1: 326. 1911. China (Fujian, Jiangxi, Taiwan, and Zhejiang).

11. **Pleione forrestii** Schlechter, Notes Bot. Gard. Edinb. 5: 106. 1912. Myanmar and China (Yunnan).

12. **Pleione grandiflora** (Rolfe) Rolfe, Orchid Rev. 11: 291. 1903 (Oct.). China (Yunnan).

13. **Pleione hookeriana** (Lindley) B. S. Williams, Orch. Grow. Man. (ed. 6) 548. 1885. Bhutan, Myanmar, China (Guangdong, Guangxi, Guizhou, Yunnan, and Xizang), India (Assam), Laos, Nepal, Sikkim, and Thailand.

14. **Pleione praecox** (J. E. Smith) D. Don, Prodr. Fl. Nepal. 37. 1825. Myanmar, India (Assam and Manipur), and Nepal.

15. **Pleione kohlsii** Braem, Schlechteriana 2(4): 168. 1991. China (Yunnan). (= *Pleione forrestii* × *P. chunii*, hybr. nat.)

16. **Pleione limprichtii** Schlechter, Feddes Repert. Sp. Nov. Beih. 12: 346. 1922. Myanmar and China (Sichuan and Yunnan).

17. **Pleione pleionoides** (Kraenzlin ex Diels) Braem & H. Mohr, Orchis 65/66: 126. 1989. China (Guizhou, Hubei, and Sichuan).

18. **Pleione scopulorum** W. W. Smith, Notes Bot. Gard. Edinb. 13: 218. 1921. Myanmar, China (Yunnan and Xizang), and India (Assam).

19. **Pleione yunnanensis** (Rolfe) Rolfe, Orchid Rev. 11: 292. 1903 (Oct.). Myanmar and China (Guizhou, Sichuan, and Yunnan).

KEY TO THE SECTIONS OF *PLEIONE*

1a. Flowering in autumn; pseudobulbs turbinate, 2-leaved (1-leaved in *P. saxicola*), often mottled or warted; basal sheaths of the inflorescence inflated or warted . . . . . sect. *Pleione*

1b. Flowering in spring; pseudobulbs ovoid to flask-shaped, narrowed gradually at the apex, 1-leaved (2-leaved in *P. scopulorum*), never mottled or warted; basal sheaths of the inflorescence smooth . . . . . sect. *Humiles*

Acknowledgment. We thank Richard K. Brummitt, Phillip Cribb, William D'Arcy, and Hong Song for help with the manuscript.

Literature Cited

Cribb, P. J. & I. Butterfield. 1988. The Genus *Pleione*. Timber Press, Portland, Oregon.

———, C. Z. Tang & I. Butterfield. 1983. The genus *Pleione*. Curtis's Bot. Mag. 184: 93–147.

Don, D. 1825. Pp. 36–37 *in* Prodromus Florae Nepalensis. J. Gale, London.

Farr, E. R., J. A. Leussink & F. A. Stafleu. 1979. Index Nominum Genericorum (Plantarum), Vol. III: 1364. The Hague, Utrecht.

Greuter, W., F. R. Barrie, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva, P. Trehane & J. McNeill (Editors). 1994. International Code of Botanical Nomenclature (Tokyo Code). Regnum Veg. 131.

Pfitzer, E. & F. Kraenzlin. 1907. *Pleione* D. Don. *In:* A. Engler, Das Pflanzenreich IV. 50. (Heft 32): 119–129. Wilhelm Engelmann, Berlin.

Pfeiffer, L. 1874. Nomenclator botanicus 2: 754. Theodori Fischeri, Cassellis.

Novelties in Chinese *Populus* and *Salix* (Salicaceae)

Guanghua Zhu
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Populus wenxianica* Z. C. Feng & J. L. Guo ex G. Zhu and *Salix suchowensis* Cheng ex G. Zhu are validly published here by the designation of holotypes. Nine new combinations, *Salix alfredii* Görz ex Rehder & Kobuski var. *fengxianica* (N. Chao) G. Zhu, *S. eriostachya* Wallich ex Andersson var. *lineariloba* (N. Chao) G. Zhu, *S. fargesii* Burkill var. *kansuensis* (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, *S. nipponica* Franchet & Savatier var. *mengshanensis* (S. B. Liang) G. Zhu, *S. opsimantha* C. K. Schneider var. *wawashanica* (Mao & P. X. He) G. Zhu, *S. oritrepha* C. K. Schneider var. *amnematchinensis* (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, *S. sinica* (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, *S. sinica* var. *dentata* (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, and *S. sinica* var. *subsessilis* (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu are proposed. *Salix hylonoma* C. K. Schneider var. *liocarpa* (Görz) G. Zhu and *S. spodiophylla* Handel-Mazzetti var. *liocarpa* (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu are new statuses and combinations.

For the treatment of the Salicaceae in the *Flora of China,* valid publication of two species is needed; nine new combinations are also required; and two forms need to be raised to varietal rank. All are accomplished here.

Populus wenxianica Z. C. Feng & J. L. Guo ex G. Zhu, sp. nov. TYPE: China. Gansu: Wenxian, Zhongzhai, *J. F. Liu 88001* (holotype, GAUF).

This species is based on *Populus wenxianica* Z. C. Feng & J. L. Guo, which was incompletely described in *Acta Botanica Boreali-Occidentalia Sinica* (Feng & Guo, 1990: 132). These authors neglected to select an item among the four cited specimens to typify this name. According to the *International Code of Botanical Nomenclature* (Greuter et al., 1994, Articles 8.1 and 37.1), a name of a taxon published after 1958 must have a single-element type cited in order to be valid. Therefore, by the designation of a holotype, the valid publication of the name is achieved here.

The four specimens cited by Feng and Guo are from the same locality of Zhongzhai in Wenxian, Gansu, China: *J. L. Guo 88008* (♀ inflorescence), *J. F. Liu 88001* (♂ inflorescence), *J. L. Guo 89003* (infructescence), and *J. L. Guo 88012* (infructescence). One of the key characters differentiating this species from its close relative, *P. gansuensis* C. Wang & H. L. Yang, is its many stamens, which are present on the specimen *J. F. Liu 88001.* Therefore, *J. F. Liu 88001* is designated here as the holotype of *P. wenxianica.*

Salix alfredii Görz ex Rehder & Kobuski var. **fengxianica** (N. Chao) G. Zhu, comb. nov. Basionym: *Salix fengxianica* N. Chao, Acta Bot. Bor.-Occid. Sin. 5(2): 115. 1985. TYPE: China. Shaanxi: Fengxian County, *Jinhua He 2396* (holotype, NWFC).

This variety differs from variety *alfredii* only in having glabrous ovaries.

Salix eriostachya Wallich ex Andersson var. **lineariloba** (N. Chao) G. Zhu, comb. nov. Basionym: *Salix dolia* C. K. Schneider var. *lineariloba* N. Chao, Bull. Forest. Pl. Res. 3: 4. 1985. TYPE: China. Sichuan: Jiulong, *Neng Chao 3788* (holotype, SCFI).

This variety differs from *Salix eriostachya* var. *eriostachya* only in having a smaller bract, shorter peduncle, and a more or less stipitate ovary, but it is distinguished sharply from *S. dolia* C. K. Schneider by having a deeply bilobed style and stigmas.

Salix fargesii Burkill var. **kansuensis** (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, comb. nov. Basionym: *Salix kansuensis* K. S. Hao ex C. F. Fang & Skvortsov, Novon 8: 468. 1998. TYPE: China. Gansu: Wutu County, Lan Shan, 2500 m, *K. S. Hao 462* (holotype, PE).

This variety differs from variety *fargesii* in having glabrous ovaries and capsules. However, specimens of variety *fargesii* sometimes also have pilose ovaries. The variety *kansuensis* may be just a synonym of variety *fargesii.*

Salix hylonoma C. K. Schneider var. **liocarpa** (Görz) G. Zhu, stat. nov. Basionym: *Salix hylonoma* Schneider f. *liocarpa* Görz, Bull. Fan Mem. Inst. Biol. (Bot.) 6(1): 17. 1935. TYPE: China. Sichuan: *Wang 301* (holotype, ?PE).

This variety differs from variety *hylonoma* in having glabrous ovaries.

Salix nipponica Franchet & Savatier var. **mengshanensis** (S. B. Liang) G. Zhu, comb. nov. Basionym: *Salix triandra* L. var. *mengshanensis* S. B. Liang, Bull. Bot. Res., Harbin 8(2): 63. 1988. TYPE: China. Shandong: Mengyin County, Mengshan, *S. B. Liang 86005* (holotype, SDFS).

The European species *Salix triandra* is currently accepted as not occurring in China (C. F. Fang & A. Skvortsov, pers. comm.). Its inclusion in the *Flora Reipublicae Popularis Sinicae* (Wang & Fang, 1984) was due to the misidentification of some specimens of *S. nipponica*, which differs from *S. triandra* in having whitish powder on the second-year branches. Based on its description (Liang, 1988), this variety is more properly placed under *S. nipponica* and differs from variety *nipponica* in having long whitish hairs on buds and new branches and female flowers without a dorsal gland.

Salix opsimantha C. K. Schneider var. **wawashanica** (Mao & P. X. He) G. Zhu, comb. nov. Basionym: *Salix oreinoma* Schneider var. *wawashanica* Mao & P. X. He, Acta Bot. Yunnan. 9(1): 47. 1987. TYPE: China. Yunnan: Jingdong County, North Wawashan, 2300 m, *Anquan Wu 9345* (holotype, KUN).

In the *Flora Reipublicae Popularis Sinicae* (Wang & Fang, 1984), the species described under *Salix oreinoma* C. K. Schneider is, in fact, *S. opsimantha* C. K. Schneider, and vice versa (C. F. Fang & A. Skvortsov, pers. comm.). The illustration captioned *S. oreinoma* on plate 54 of the *Flora* depicts *S. opsimantha*. *Salix oreinoma* C. K. Schneider var. *wawashanica* Mao & P. X. He was described under the wrong species because of the error in the *Flora* (Mao & Li, 1987) and should therefore be a variety of *S. opsimantha*.

Salix oritrepha C. K. Schneider var. **amnematchinensis** (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, comb. nov. Basionym: *Salix amnematchinensis* K. S. Hao ex C. F. Fang & Skvortsov, Novon 8: 467. 1998. TYPE: China. Qinghai: Gan Ba, 4500 m, *K. S. Hao 1039* (holotype, PE).

This variety differs from variety *oritrepha* only in having elliptic-ovate or elliptic-lanceolate leaves. Leaves of variety *oritrepha* are often elliptic or ovate.

Salix sinica (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, comb. nov. Basionym: *Salix caprea* L. var. *sinica* K. S. Hao ex C. F. Fang & Skvortsov, Novon 8: 467. 1998. TYPE: China. Hebei: Wuliang Shan, 1270 m, *K. M. Liu 49* (holotype, PE).

This variety is based on *Salix caprea* L. var. *sinica* K. S. Hao, described among many other taxa without Latin diagnoses in the well-known "Synopsis of Chinese *Salix*" (Hao, 1936), and validated in this issue of *Novon* by C. F. Fang and A. K. Skvortsov.

Specimens of *Salix sinica* from northern and northeastern China have often been misidentified as *S. caprea*. However, the former species can be distinguished by its having filaments six to seven times longer than the bracts, ovaries longer than the pedicels, and often thick, pubescent leaves.

Salix sinica was invalidly proposed in the *Flora Reipublicae Popularis Sinicae* (Wang & Fang, 1984: 304) based on the then invalid *S. caprea* L. var. *sinica* K. S. Hao. Therefore, the valid publication of the combination is achieved only here. The species is currently recognized as having three varieties: var. *sinica*, var. *dentata*, and var. *subsessilia*.

KEY TO VARIETIES OF *SALIX SINICA*

1a. Ovary distinctly stipitate.
  2a. Leaf margins often entire or irregularly toothed; leaves cuneate at base and acute-acuminate at apex . . . . . var. *sinica*
  2b. Leaf margins often regularly toothed; leaves ± rounded at base and often obtuse (rarely acute) at apex . . . . . var. *dentata*
1b. Ovary subsessile . . . . . var. *subsessilis*

Salix sinica (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu var. **dentata** (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, comb. nov. Basionym: *Salix caprea* L. var. *dentata* K. S. Hao ex C. F. Fang & Skvortsov, Novon 8: 467. 1998. TYPE: China. Hebei: Zhou County, Xiao Wutai Shan, *H. W. Kuang 149* (holotype, PE).

This variety is based on *Salix caprea* L. var. *dentata* K. S. Hao, described among many other taxa without Latin diagnoses in Hao (1936), and validated in this issue of *Novon* by C. F. Fang and A. K. Skvortsov. It differs from variety *sinica* in having leaf margins often regularly toothed and leaves more or less rounded at the base and often obtuse (rarely acute) at the apex; it differs from variety *subsessilia* in having distinctly stipitate ovaries.

Salix sinica (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu var. **subsessilis** (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, comb. nov. Basionym: *Salix caprea* L. var. *subsessilis* K. S. Hao ex C. F. Fang & Skvortsov, Novon 8: 468. 1998. TYPE: China. Hebei: Yi County, Xiaowude Shan, *K. M. Liu 2405* (holotype, PE).

This variety is based on *Salix caprea* L. var. *subsessilis* K. S. Hao, described among many other taxa without Latin diagnoses in Hao (1936), and validated in this issue of *Novon* by C. F. Fang and A. K. Skvortsov. It differs from variety *sinica* and variety *dentata* in having subsessile ovaries.

Salix spodiophylla Handel-Mazzetti var. **liocarpa** (K. S. Hao ex C. F. Fang & Skvortsov) G. Zhu, stat. nov. Basionym: *Salix spodiophylla* f. *liocarpa* K. S. Hao ex C. F. Fang & Skvortsov, Novon 8: 469. 1998. TYPE: China. Sichuan: Yongning County, *Forrest 21263* (holotype, ?PE).

This variety is based on *Salix spodiophylla* f. *liocarpa* K. S. Hao, described among many other taxa without Latin diagnoses in Hao (1936), and validated in this issue of *Novon* by C. F. Fang and A. K. Skvortsov. It differs from variety *spodiophylla* in having glabrous ovaries.

Salix suchowensis Cheng ex G. Zhu, sp. nov. TYPE: China. Jiangsu: Nanjing, *J. L. Guo 89012* (holotype, NF).

This species is based on *Salix suchowensis* Cheng, which was incompletely described in *Scientia Silvae Sinica* (Cheng et al., 1963: 8). Two specimens, *J. L. Guo 89012* (♀) and *Cheng 20641* (♂), were cited without the indication of a type. According to the *Code* (Greuter et al., 1994, Article 8.1, 37.1), the valid publication of the name is achieved here by the designation of the single specimen *J. L. Guo 89012* as the holotype. This specimen is in good condition and has the diagnostic characters of the species.

Acknowledgments. I thank Zhenfu Fang and Marshall R. Crosby for critical suggestions on the topic. I also thank Alexei Skvortsov, Nick Turland, William D'Arcy, and Tuoya Ding for many useful discussions. I am grateful to Xinfen Gao and Hong Song for help with the manuscript. Special thanks go to the staffs of A, CDBI, GH, IFP, KUN, PE, and SZ for the opportunities to work in these herbaria.

Literature Cited

Cheng, W. J., S. Y. Zhang, T. Hong, Z. D. Zhu & Q. Z. Zhao. 1963. Species novae et nomines emendata arborum utilium Chinae. Sci. Silv. Sin. 8(1): 1–14.

Greuter, W., F. R. Barrie, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva, P. Trehane & J. McNeill (Editors). 1994. International Code of Botanical Nomenclature (Tokyo Code). Regnum Veg. 131.

Feng, Z. C. & J. L. Guo. 1990. A new species in *Populus*. Acta Bot. Boreal. Occid. Sin. 10(2): 132–134.

Hao, K. S. 1936. Synopsis of Chinese *Salix*. Repert. Spec. Nov. Regni Veg. Beih. 93: 1–123.

Liang, S. B. 1988. A new variety of *Salix* from Shandong. Bull. Bot. Res., Harbin 8(2): 63–65.

Mao, P. Y. & W. Z. Li. 1987. Plantae Novae Salicacearum (2). Acta Bot. Yunnan. 9: 43–53.

Wang, C. & C. F. Fang. 1984. Salicaceae. Flora Reipublicae Popularis Sinicae 20(2): 1–403. Science Press, Beijing.

Validation of Hao's New Chinese Taxa in *Salix* (Salicaceae)

Fang Chen-Fu
Institute of Applied Ecology, Chinese Academy of Sciences, 72 Wenhua Road, Shenyang, Liaoning 110015, People's Republic of China

Alexei K. Skvortsov
Herbarium, Main Botanical Garden, Russian Academy of Sciences, 4 Botanicheskaya, 127276 Moscow, Russia

ABSTRACT. Thirty-four previously invalidly published taxa of Chinese *Salix* are validated. These include 14 sections (*Allochroae, Biondianae, Cathayanae, Cheilophilae, Chingianae, Dodecandrae, Doliae, Eriocladae, Ernestia, Floccosae, Tangia, Tetradeniae, Variegatae,* and *Wilsonia*), 15 species (*S. acuminatomicrophylla, S. amnematchinensis, S. chingiana, S. crenata, S. forrestii, S. hupehensis, S. kansuensis, S. lamashanensis, S. ovatomicrophylla, S. pseudowolohoensis, S. shansiensis, S. schneideriana, S. tangii, S. wangiana,* and *S. wuiana*), 4 varieties (*S. atopantha* var. *glabra, S. caprea* var. *dentata, S. caprea* var. *sinica,* and *S. caprea* var. *subsessilis*), and 1 form (*S. spodiophylla* f. *liocarpa*).

In his outstanding "Synopsis of Chinese *Salix*," Hao (1936) described several new sections, species, and infraspecific taxa and provided excellent descriptions in English but failed to provide Latin diagnoses for any of his new taxa. Therefore, according to Article 36.1 of the *International Code of Botanical Nomenclature* (Greuter et al., 1994), none of his new taxa is validly published. Unfortunately, many of his new species have been widely used in local Chinese floras even though they are invalid. In some cases, Hao (1936) cited two specimens as types, one staminate and the other pistillate, but this contradicts Article 37, making these names also invalid. Fortunately, Hao provided photographs of the types of the new taxa, and that helped in the typification process. The present paper validates all of the new taxa proposed by Hao. The English descriptions are not repeated here; the interested reader should refer to Hao's publication for those and the photographs.

NEW SPECIES AND INFRASPECIFIC TAXA

Salix acuminatomicrophylla K. S. Hao, sp. nov. TYPE: China. Yunnan: Montes Moting, Yangtze-Mekong divortium, *J. F. Rock 10346* (holotype (♀), B). See Hao (1936: 53, fig. 16).

Fruticulus ad 3 cm altus; ramis luteobrunneis, procumbentibus, glabris; gemmis obtusis, glabris. Folia rigide coriacea, elliptico-lanceolata, basi apiceque acuta, supra viridia glabra, subtus pallida, integerrrima, 2.5–3.5 mm longa, 1.5–2 mm lata, subsessilia. Amenta feminea sessilia, ca. 3 mm longa crassaque, 2–3-flora; rhachidi glabra; glandula ventralis anguste oblonga; ovarium glabrum breviter pedicellatum, stylo brevi apice bilobo. Amenta mascula usque ad 5 mm longa, ca. 3 mm crassa, 3- vel 4-flora; rhachidi villosa; bracteis oblongo-spathulatis, obtusis, utrinque glabris, longitudinem ca. ½ filamenti aequantibus. Flos masculis glandulis 2, filamentis glabris vel basi pilosis, antheris ellipsoideis.

Salix amnematchinensis K. S. Hao, sp. nov. TYPE: China. Qinghai: Cheihki gan ba, 4500 m, 27 Aug. 1930, *K. S. Hao 1039* (holotype (♀), PE). See Hao (1936: 74, fig. 44).

Frutex pumilus erectus, ramis brunneis glabris. Folia elliptico-ovata 8–20 mm longa, 6–12 mm lata, apice acuta, basi late cuneata, utrinque margine integra, utrinque glabra, supra viridia, subtus glauca vel viridula; petiolo 2–5 mm longo, flavescente glabro. Amenta feminea capitata, ca. 10 mm longa; bracteis orbiculatis, utrinque pilosis, longitudinem ca. ½ ovarii aequantibus. Flos femineus ovario piloso, sessili, stylo et stigmate indistinctis. Capsula ovoidea ca. 3.5 mm longa.

Salix atopantha C. K. Schneider var. **glabra** K. S. Hao, var. nov. TYPE: China. Zhejiang: Tien mu shan, *K. K. Troong 63* (holotype (♀), PE). See Hao (1936: 70).

Haec varietas a typo speciei bracteis glaberrimis apice ovatis differt.

Salix caprea L. var. **dentata** K. S. Hao, var. nov. TYPE: China. Hebei: Hsiao wu tai shan, on the moist slope, 29 May 1930, *H. W. Kung 149* (holotype, PE). See Hao (1936: 91, fig. 66).

Folia ovata margine dentata, basi rotundata, apice obtusa, 7–10 cm longa, 5–6 cm lata.

Salix caprea L. var. **sinica** K. S. Hao, var. nov. TYPE: China. Hebei: Wu ling shan, alt. 1270 m, 31 May 1931, *Liou 49* (holotype, PE). See Hao (1936: 91, fig. 67).

Folia anguste lanceolata vel rhombico-lanceolata, basi attenuata, apice acuta, margine integerrima, 3.5–6(–8) cm longa, 1.5–2.5(–3.2) cm lata. Infructescencia pedicellis 2.5–3 mm longis, capsula 8–9 mm longa.

Salix caprea L. var. **subsessilis** K. S. Hao, var. nov. TYPE: China (as Chakar). Yii hsien, *Liou 2405* (holotype, PE). See Hao (1936: 92).

Folia ut in varietate praecedente. Infructescencia pedicellis usque ad 0.5 mm tantum longis. Capsula ca. 4 mm longa.

Salix chingiana K. S. Hao, sp. nov. TYPE. China. Gansu: Lan ze cheon kou, near Sining, alt. 2650–3100 m, 23 July 1923, *R. C. Ching 584* (holotype (♀), A). See Hao (1936: 86, fig. 60).

Arbuscula ad 7 m alta; ramulis atro-purpureis glabris. Folia lanceolata, 7–10 cm longa, 17–20 mm lata, apice acuta, basi attenuata, vulgo utrinque glabra, supra viridia, subtus pallentia, margine glanduloso-serrata, petiolo ca. 13 mm longo, glabro glandifero. Amenta feminea elongata, ad 10 cm longa (in fructu), rhachidi pilosa pedunculo basi 2–3 foliis suffulto; bracteis ovatis utrinsecus parce pilosis. Flos femineus glandula 1 ventrali cylindrica, pedicellum fere aequanti; ovario glabro, elliptico-oblongo, longe pedicellato.

Salix crenata K. S. Hao, sp. nov. TYPE: China. Yunnan: Yangtze watershed district of Lijiang, W slope of Lijiang Snow Range, May–Oct. 1922, *J. F. Rock 4948* (holotype (♂), B). See Hao (1936: 50, fig. 11).

Frutex pronus. Folia ovata, utrinque ovata vel obtusa, margine crenulata, 6–7 mm longa, 3–4 mm lata, supra atroviridia nitida, subtus viridula utrinque quam nervoso-rugosa. Amenta mascula capitata pauciflora; bracteis ellipticis, 3-nervibus, glabris, longitudinem fere ½ staminium aequantibus. Flos masculus glandulis cylindricis, glandula ventrali quam dorsali multo longiore, staminibus 2 inaequalibus, filamentis glabris.

Salix forrestii K. S. Hao, sp. nov. TYPE: China. Yunnan: without locality, *Forrest 5718* (holotype (♀), B). See Hao (1936: 69, fig. 38).

Frutex erectus, ramis brevibus plus-minusve tomentosis. Folia oblongo-lanceolata, basi rotundata vel late cuneata, apice acuta, margine integerrima, supra laete viridia et secus nervos pilosa, subtus glauca parce pilosa, 4–6 cm longa, 15–20 mm lata. Amenta feminea sessilia, 1–3 foliis subtus sericeis suffulta, 7–8 cm longa, 8–11 mm crassa, rhachidi tomentosa; bracteis orbiculatis extus dense intus leviter pilosis, longitudinem dimidiam ovarii aequantibus. Flos femineus glandula ventrali elliptica fusca.

Salix hupehensis K. S. Hao, sp. nov. TYPE: China. Hubei: Chang Yang, *Wilson 685* (holotype (♀), B). See Hao (1936: 106, fig. 80).

Frutex erectus; ramis nigrato-brunneis, glabris, ramulis villosis. Folia ovato-lanceolata usque lineari-lanceolata, 3–5 cm longa, 10–14 mm lata, apice acuminata vel acuta, basin versus attenuata vel late cuneata, margine integra, supra atroviridia secus costas parce pilosa, subtus sericeo-tomentosa, petiolo 3–5 mm longo. Amentum femineum cum pedunculo ca. 4 cm longum, 4 mm crassum, basi 2 vel 3 foliis normalibus suffultum; bracteis elliptico-oblongis, extra dense pubescentibus, intra subglabris, fere ovarium aequantibus vel leviter superantibus. Flos femineus glandula 1 ventrali orbiculata; ovario sessilii piloso, ovato-elliptico, ca. 1.5 mm longo, stylo brevi, stigmatibus 2 gracilibus bilobis.

Salix kansuensis K. S. Hao, sp. nov. TYPE: China. Gansu: Wu tu hsien, Lan shan, alt. 2500 m, 19 June 1930, *K. S. Hao 462* (holotype (♀), PE). See Hao (1936: 61, fig. 26).

Arbor ad 6 m alta; ramis glabris atro-purpureis, gemmis elliptico-oblongis atro-purpureis. Folia ovata usque elliptica vel ovato-elliptica, basi rotundata vel cordata, apice ovata, margine serrata, 7–10 cm longa, 4.5–7 cm lata, supra viridia glabra subtus viridula secus costas pubescentia, petiolo piloso vel glabrescente 10–15 mm longo supra sulcato. Amenta fructificantia ad 12 cm longa, ca. 10 mm crassa, rhachidi glabra; bracteis ellipticis utrinque pilosis, pedicello paulo longioribus. Flos femineus nectario ventrali ovato-elliptico brunneo longitudinem ½ pedicelli aequante; pedicello brevi; ovario glabro ovato-orbiculato, stylo indistincto, stigmatibus 2 apice bifidis.

Paratype. CHINA. **Shanxi:** Ning shan hsien, alt. 2000 m, 25 July 1933 (♀), *H. W. Kung 3224* (PE).

Salix lamashanensis K. S. Hao, sp. nov. TYPE: China. Gansu: Minchow Lamashan, alt. 3500 m, 5 July 1930, *K. S. Hao 650* (holotype (♀), PE). See Hao (1936: 99, fig. 77).

Arbuscula, ramis nigrescentibus glabris. Folia spathulato-lanceolata, 4–6 cm longa, apice acuta, basi anguste attenuata, supra viridia glabra, subtus viridula, margine revoluta, remote serrata. Amenta feminea subsessilia capitata, basi folio integro suffulta; bracteis elliptico-oblongis, longitudinem ca. ½ ovarii aequantibus, extra parce pilosis, intra glabris. Flos femineus glandula 1 ventralia cylindrica; ovario sessili, pubescente ovoideo-ovato; stylo brevi, stigmate indistincto.

Salix ovatomicrophylla K. S. Hao, sp. nov. TYPE: China. Yunnan: Yangtze watershed, prefectural district of Lijiang, 4000 m, Aug. 1914, *Schneider 2318* (holotype (♂ ♀), B). See Hao (1936: 53, fig. 15).

Frutex nanus ad 3 cm altus; ramis humifusis flavescenti-brunneis, glabris; gemmis obtuse ovatis, glabris. Folia coriacea, elliptica, 3–6 mm longa, 1.5–2.5 mm lata, apice obtusa, supra atroviridia glabra, subtus pallida vel glauca, petiolo 1–4 mm longo. Amenta mascula 3–5-flora, ca. 6 mm longa et crassa, stamina filamentis liberis glabris, glandulae 2. Amenta pistillata capitata, ca. 3 mm longa et crassa, sessilia, pauciflora. Flos femineus glandula 1;

ovario ovato-elliptico subsessili glabro, stylo et stigmate brevibus. Capsula ca. 3 mm longa, sessilis.

Salix pseudowolohoensis K. S. Hao, sp. nov. TYPE: China. Yunnan: Yangtze watershed, prefectural district of Lijiang, E slope of Lijiang Snow Range, May–Oct. 1922, *J. F. Rock 3353* (holotype (♀), B). See Hao (1936: 80, fig. 56).

Frutex erectus, ramis tomentosis. Folia lanceolato-oblonga, supra atro-viridia pilosa, subtus sericeo-tomentosa, 3–5 cm longa, 8–15 mm lata, utroque acuta; petiolo brevissimo ver nullo. Amenta feminea terminalia, basi foliis 4 vel 5 subtus sericeis integris suffulta; bracteis ovatis utrinque glabris, pedicello paulo longioribus. Flos femineus glandula 1 ventrali elliptica; ovario glabro, breve pedicellato, ovoideo-obovoideo; stylo brevissimo, stigmate capitato. Capsula ovoidea, pedicellata.

Salix shansiensis K. S. Hao, sp. nov. TYPE: China. Shansi, Chiao cheng, Yun ting shan, ca. 2100 m, *H. Smith 7739* (holotype, UPS). See Hao (1936: 102).

Frutex, ramis flexibilibus viridibus glabris; gemmis purpurascentibus coriaceis lucidis ovatis ca. 5 mm longis. Folia linearia 10–12 cm longa, 2–4 mm lata, supra lucide viridia, subtus dilute viridia, utrinque glabra, margine serrata, in petiolum glabrum lutescentem ad 10 mm longum sensim attenuata.

Salix schneideriana K. S. Hao, sp. nov. TYPE: China. Yunnan: ad passas in reg. Tali-fu, 2300 m, Oct. 1914, *C. Schneider 3273* (holotype (♂), B). See Hao (1936: 110, fig. 84).

Frutex erectus, ramis puberulis serius, glabrescentibus; gemmis brunneis, pubescentibus, petiolis longioribus. Folia spathulato-oblonga, 2.5–4.5 cm longa, 4–9 mm lata, supra lucide viridia, subtus cinerascentia vel glauca, sparse pilosa, margine revoluto remote glanduloso-serrato, nervo mediano subtus lato glabro lutescente, petiolo ca. 4 mm longo pubescente. Amenta mascula sessilia, 2–3.5 cm longa, 6–7 mm crassa, densa. Flos masculus filamentis 2 connatis, sed antheris separatis, glabris.

Salix spodiophylla Handel-Mazzetti f. **liocarpa** K. S. Hao, forma nov. TYPE: China. Sichuan: open bouldery alpine meadows on the mountain E of Yung ning, *Forrest 21263* (holotype (♀), E). See Hao (1936: 88).

Haec forma a typo speciei ovario glabro differt.

Salix tangii K. S. Hao, sp. nov. TYPE: China. Shanxi: southern part, alt. 1800 m, Ping yao hsien, 19 May 1929, *T. Tang 794* (holotype (♀), A). See Hao (1936: 78, fig. 53).

Arbuscula 1.5–2 m alta; cortice cinereo-viridi laevi; ramis purpureo-fuscis glabris. Folia oblonga vel elliptico-oblonga, glabra, supra viridula, subtus albescentia, apice acuta vel obtusa, basi rotundata vel late attenuata, 1.5–4 cm longa, 10–15 mm lata; petiolo 4–5 mm longo, glabro. Amenta feminea gracilia, cylindrica, ca. 3.5 cm longa, ca. 4 mm crassa, rhachidi villosa; bracteis latis orbiculatis, utrinque glabris. Flos femineus glandula 1 ventrali cylindrica, longitudinem ½ bracteae subaequante; ovario sessili, glabro, ovoideo-obovato; stylo brevissimo, stigmate subcapitato.

Salix wangiana K. S. Hao, sp. nov. TYPE: China. Shanxi: Tai Pai Shan, alt. 2700 m, 4 Aug. 1933, *T. P. Wang 1769* (holotype (♀), P). See Hao (1936: 81).

Frutex 2–3 m altus; ramis vulgo erectis nigrescentibus glabris. Folia ovata vel elliptica, glabra, apice rotundata, basi late attenuata vel rotundata, 3–5 cm longa, 2.5–3.5 cm lata, supra obscure viridia, subtus glauca, margine remote denticulata; petiolo glabro, 5–15 mm longo. Amenta fructifera ca. 5–6 cm longa, subsessilia, basi foliis suffulta; bracteis elliptico-oblongis, utrinque glabris, ovario triplo brevioribus. Flos femineus glandula 1 ventrali; ovario sessili, glabro, elliptico-oblongo; stylo gracili, ca. 1.5 mm longo, stigmatibus 2.

Salix wuiana K. S. Hao, sp. nov. TYPE: China. Shansi: Tai pai shan, *W. Purdom 979* (holotype (♀), A). See Hao (1936: 95, fig. 72).

Frutex erectus, ramis anni praecedentis purpureo-rubris, glabris, lucidis, ramulis junioribus pubescentibus; gemmis orbicularibus rubris parvulis ca. 1.5 mm in diametro, glabris. Folia rhombico-ovata 1.5–3.5 cm longa, 1–2.5 cm lata, apice acuta, supra laete viridia, subtus, praesertim juniora, plus minusve pubescentia; petiolo ca. 5 mm longo. Amenta feminea subsessilia 4–5 cm longa, ca. 6 mm crassa; bracteis rotundatis, extus longe pilosis, intus subglabris. Flos femineus glandula ventrali cylindrica; ovarium breviter pedicellatum pubescens; stylus brevis, stigma oblongum.

New Sections

Salix sect. **Allochroae** K. S. Hao, sect. nov. TYPE: *Salix allochroa* C. K. Schneider. See Hao (1936: 62).

Species huius sectionis a speciebus sect. *Magnificarum* ovario tomentoso differunt.

Salix sect. **Biondianae** K. S. Hao, sect. nov. TYPE: *Salix biondiana* Seemen. See Hao (1936: 74).

Frutices humiles ramosissimi. Folia ovata ad obovato-elliptica, utrinque obtusa, margine integro, petiolo ½–⅓ longitudinis laminae. Amenta brevia 10–15 mm longa, 6–8 mm crassa. Flos femineus ovario vulgo sessili piloso.

Salix sect. **Cathayanae** K. S. Hao, sect. nov. TYPE: *Salix cathayana* Diels. See Hao (1936: 78).

Frutex. Folia lanceolata vel oblonga, rarius obovata, serrata vel denticulata, ad anthesin ca. 10–15 cm longa, 4–6 mm lata. Amenta mascula 2–7 cm longa, feminea 4–10 cm longa. Flos masculus femineusque glandula unica; ovario glabro sessili vel breviter pedicellato.

Salix sect. **Cheilophilae** K. S. Hao, sect. nov. TYPE: *Salix cheilophila* Schneider. See Hao (1936: 102).

Folia linearia, 3–12 cm longa, 2–5 mm lata. Amenta capitata usque cylindrica, 5–15 mm longa, basi 1–5 foliis integris suffulta. Flores glandula 1 ventrali; filamentis connatis; ovario sessili piloso (praeter *S. microstachyam*), stylo indistincto.

Salix sect. **Chingianae** K. S. Hao, sect. nov. TYPE: *Salix chingiana* Hao. See Hao (1936: 85).

Arbores vel frutices. Folia lanceolata apice acuta vel longe acuminata, glabra, petiolo 6–15 mm longo. Amenta elongata 4–6 cm longa, basi 3–5 foliis normalibus suffulta. Flores masculi glandula unica, filamentis liberis 2; feminei ovario glabro. Capsula ovoidea.

Salix sect. **Dodecandrae** K. S. Hao, sect. nov. TYPE: *Salix dodecandra* Léveillé. See Hao (1936: 45).

Folia lineari-lanceolata, petiolo brevi eglanduloso. Amenta mascula coaetanea; amenta feminea rhachidi tomentosa, bracteis pilosis. Flos masculis glandulis 2 (ventrali longiore); flos femineus glandulis 2 plus minusve connatis, ovario glabro, stylo indistincto.

Salix sect. **Doliae** K. S. Hao, sect. nov. TYPE: *Salix dolia* C. K. Schneider. See Hao (1936: 95).

Frutices erecti. Folia ovalia ad linearia. Amenta breviter cylindrica. Flores masculi glandula 1 ventrali, filamentis liberis; feminei glandula 1, ovario sessili pubescente, stylo brevi, stigmate oblongo.

Salix sect. **Eriocladae** K. S. Hao, sect. nov. TYPE: *Salix erioclada* Léveillé. See Hao (1936: 69).

Frutex vel arbuscula. Folia elliptica usque lanceolata, sub anthesi 8–20 mm longa, subtus sericea vel sericeo-tomentosa raro glabra, petiolo brevi vel fere nullo. Amenta cylindrica densiflora. Flores masculi glandulis 2, diandri. Flos femineus glandula 1 ventrali; ovario sessili sericeo vel tomentoso; stylo bipartito vel bilobo stigmate bifido.

Salix sect. **Ernestia** K. S. Hao, sect. nov. TYPE: *Salix ernestii* C. K. Schneider. See Hao (1936: 67).

Folia tomentosa vel dense pilosa saltem subtus, lanceolata, apice acuminata 8–20 cm longa, petiolo elongato. Amenta 7–12 cm longa, 10–12 mm crassa, ramulos foliferos terminantia. Flores masculi ac feminei glandulis 2 (in femineis glandula dorsali interdum deficiente); ovario sessili sericeo vel tomentoso, stylo brevi, stigmate gracili.

Salix sect. **Floccosae** K. S. Hao, sect. nov. TYPE: *Salix floccosa* Burkill. See Hao (1936: 54).

Frutex pumilus 30–100 cm altus. Folia ovata usque obovata secus marginem glandulose crenato-serrata; petiolo longitudinem ⅓ laminae aequante. Amenta terminalia. Flores masculi glandulis 2; flos femineus glandula 1 ventrali, ovario sessile (praeter *S. calyculatam* Hooker).

Salix sect. **Tangia** K. S. Hao, sect. nov. TYPE: *Salix tangii* K. S. Hao. See Hao (1936: 74).

Frutices. Folia ovato-oblonga margine integro (*S. charácta* C. K. Schneider excepta), utrinque acuta vel obtusa, vulgo glabra, petiolo 2–5 mm longo. Amenta gracilia 2.3–4.5 cm longa, 4–6(–8) mm crassa, distincte pedunculata, mascula laxiflora. Flores glandulis singulis (in *S. dissa* glandulis duabus); flores feminei glandulis ventralibus tantum, ovario glabro sessili.

Salix sect. **Tetradeniae** K. S. Hao, sect. nov. TYPE: *Salix tetradenia* Handel-Mazzetti. See Hao (1936: 63).

Folia lineari-lanceolata vel lanceolata, margine integro vel serrato, subtus saepissime pilosa. Amenta sessilia, gracilia, 2–6 cm longa, 3–6 mm crassa; bracteis orbicularibus utrinque glabris. Flores masculi cum glandulis 2 vel 4, filamentis basi pilosis; flos femineus ovario sessili glabro.

Salix sect. **Variegatae** K. S. Hao, sect. nov. TYPE: *Salix variegata* Franchet. See Hao (1936: 109).

Folia parva sessilia, obovata vel spathulato-oblonga, 5–20(–45) mm longa, margine revoluta glandulose denticulata, supra glabra subtus pilosa. Amenta mascula elliptico-oblonga, densiflora subsessilia basi 1 vel 2 foliis suffulta. Flos femineus glandula ventrali tantum, ovario sessili piloso, stylo brevi.

Salix sect. **Wilsonia** K. S. Hao, sect. nov. TYPE: *Salix wilsonii* Seemen. See Hao (1936: 41).

Folia elliptico-lanceolata. Amenta mascula gracilia, laxiflora; bracteis parvis, ca. dimidium pedicelli aequantibus. Flos masculus glandulis 2, femineus vulgo unica; ovario glabro, lineari usque lanceolato; pedicello ovarium aequante vel paulo superante.

Literature Cited

Greuter, W., F. R. Barrie, H. M. Burdet, W. G. Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, D. H. Nicolson, P. C. Silva, P. Trehane & J. McNeill (Editors). 1994. International Code of Botanical Nomenclature (The Tokyo Code). Regnum Veg. 131.

Hao, K. S. 1936. Synopsis of Chinese *Salix*. Repert. Spec. Nov. Regni Veg. Beih. 93: 1–123.